

PUBLIC HEALTH REPORTS

In this issue



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Sigmund Freud
1856-1939

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Published concurrently with this issue:

PUBLIC HEALTH MONOGRAPH No. 45 . . . Tobacco smoking patterns in the United States.

William Haenszel, Michael B. Shimkin, and Herman P. Miller.

111 pages; illustrated. A summary and information on availability appear on pages 1134-1136.



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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

MARION B. FOLSOM, *Secretary*

PUBLIC HEALTH SERVICE

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A Scientific Approach to Fetal Wastage In Halifax County, North Carolina

By ROBERT F. YOUNG, M.D., M.P.H.

HALIFAX COUNTY, a rural county in eastern North Carolina, had reason to search for the causes of its high infant mortality rates. The 1952 rate had soared to an all-time high of 72.9 per 1,000 live births. Neonatal and premature death rates had climbed to 42.7 and 21.4 in 1952. Prematurity was the second leading cause of death that same year, outranking cancer and accidents.

Halifax County's population of 60,000 is 58 percent Negro. The birth rate for Negroes in 1952 was 35.2 as compared with 21.5 for white residents. Only 36.2 percent of all deliveries, white and nonwhite, occurred in hospitals. The county has 25 private physicians and 2 hospitals. There are 2 hospitals in the adjacent counties also.

Midwives were called in to attend 79.9 percent of all Negro home deliveries. Patients for midwife delivery are required to be certified either by a physician in private practice or by a clinician in charge of one of the 4 prenatal clinics operated by the county health department. The midwives are licensed by and work under the direct supervision of the health department.

Dr. Young, honored in 1950 with the Reynolds award for outstanding public health performance, is director of the Halifax County (N. C.) Health Department. He has been president of the Halifax County Medical Society and more recently president of the North Carolina Public Health Association, president of the North Carolina Academy of Public Health and Preventive Medicine, and secretary-treasurer of the North Carolina Trudeau Society.

Representatives of the North Carolina State Board of Health, University of North Carolina School of Public Health, North Carolina Medical Society, Halifax County Medical Society, and the Children's Bureau of the Department of Health, Education, and Welfare joined forces with the Halifax County Health Department in seeking answers to that vexing question, "Why does immature as well as defective fruit fall from the tree of life?"

An ambitious and well-designed research project on infant mortality tailored for Halifax County and neighboring counties with high rates failed to obtain supporting funds. The county health department and the allied groups persisted in exploring ways of using available facilities and local personnel in a demonstration program that might favorably influence infant mortality and morbidity rates. During these studies and conferences, three factors seemed to occur again and again:

- The plans for demonstration programs were lacking in adequate analysis and application of pertinent data.
- The diets of prenatal clinic patients were markedly deficient in protein and in other nutrients.
- Certain of these women habitually produced fetal deaths, premature infants, or babies who failed to survive the neonatal period.

Pinpointing the Problem

With the help of statistics and health education consultants, our public health nurses and secretaries undertook to remedy the deficiency in statistical data by preparing accurate tabula-

tions of infant, neonatal, fetal, premature, and maternal deaths, by race, for the 5-year period 1947-51. These statistics, though available in the health department, had not been assembled for maximum effectiveness.

Next, they collected and assembled pertinent details on exact geographic location of the patient's home, cause of the infant or maternal death, type of attendant (whether physician or midwife), and the place of delivery (whether in the hospital or at home). They also compiled complete details about the weight, period of gestation, attendant, place, and date of delivery of premature births. Because an epidemic of infectious diarrhea in one section of the county in 1952 had contributed to the high infant death rate, they made a special study of infant deaths from infectious diarrhea, analyzing the records in a local hospital that had been particularly affected.

After all information had been checked for accuracy with the vital statistics section of the State health department, the consultants were called in to recommend the best way of presenting the material to the health department staff, professional groups in the county, and key civic and voluntary organizations. They agreed that our presentation should be a combination of tables, graphs, and large county maps on which premature births and other associated infant mortality data would be plotted by the public health nurses.

Flip charts were prepared from semitransparent tracing paper. Separate sheets of each 48" x 34" chart were superimposed over a basic map of Halifax County, showing the general outline of townships and local divisions.

It was apparent from the presentation material that most of the infant deaths had occurred in three distinct areas of the county. This epidemiological observation led us to set up a prenatal demonstration clinic in each area.

Concentrating on Diet

Attention was next directed to the nutrition of prenatal patients. Careful review of their clinic records over a 3-year period revealed that the great majority of these patients drank no milk or at best an insufficient amount. Other protein foods in their diets during pregnancy were also inadequate.

Public health studies have documented the fact that low protein diets among prenatal patients are partly responsible for high maternal, infant, and related mortality and morbidity rates. These observations were emphasized at the 1955 meeting of the American Public Health Association, when Dr. August R. Lindt, the permanent observer of Switzerland to the United Nations, reviewed the benefits of surplus milk for prenatal patients and children in 45 different countries before the National Citizens Committee of the World Health Organization.

To aid study of the nutrition factor in local infant mortality, consultants in obstetrics and nutrition helped us design a special record for appraising the characteristics of the diet of prenatal patients. Because of the large number of new cases admitted to the demonstration clinics and the limited number of personnel, the record had to be simple in form yet adequate for the desired information.

For evaluation of each patient's diet, public health nurses record the food consumed at the three meals preceding the clinic visit as well as the food eaten between meals and at bedtime. This information is entered under separate sections for "breakfast" and "between," "lunch" and "between," "supper" and "bedtime" in a column of the diet record headed "food and amounts." The food items are coded in a second column and scored in a third.

The diet is rated "good" (9-10 points), "fair" (7-9 points), and "poor" (below 7 points) according to the following guide.

Code	Food and amount	Possible score
F & V----	Fruit and vegetables----- ½ cup fruits, vegetables, or juice = 1 point	4
M-----	Milk----- 1 cup = 1 point 2 cups = 2 points 3-4 cups = 3 points	3
P-----	Protein food----- 2 servings of 3 oz. lean meat or equivalent	2
B-----	Bread and cereals----- 2 servings	1
Perfect score-----		10

As soon as these records were completed, the nutrition consultants began holding inservice training sessions for nurses, 2 hours each week

over a period of 6 weeks. Training in nutrition included a careful study of the diet records and diet histories of the demonstration patients; instruction in nutrients, food portions, and food values; and methods of teaching food values to clinic patients.

Knowing that surplus nonfat dry milk was available to public schools and other public institutions in the county, we explored the possibility of obtaining this important protein food for the prenatal patients whose diets were deficient in protein. The surplus commodity food section of the State department of agriculture approved our proposal for issuing free milk to medically indigent patients in the demonstration clinics, and the county welfare department certified their eligibility.

A patient who receives an allotment of 9 pounds of dry milk every 30 days during her pregnancy is provided with the equivalent of 1 quart of fluid milk a day. Clinic classes and individual conferences are held to show prenatal patients how to use dry milk for drinking and cooking. They learn, too, about other protein foods that are locally available.

An inventory showing the amount of milk received and distributed each month is kept for the department of agriculture. Other records include a form on which patients acknowledge receipt of the milk and agree to its use as prescribed by the clinic and a form on which public health nurses determine medical indigency.

During the first 6 months of the demonstration program, a public health nurse visited the patients participating in the milk distribution to assure that dry milk was being used in accordance with the clinic's instructions. (Home visits for this purpose have since become a part of the generalized public health nursing program.) Throughout the country, home economics teachers, home demonstration agents, and 4-H club leaders were alerted to the objectives of the surplus milk program so that they also could emphasize the importance of protein foods in prenatal diets.

Finding the Problem Patients

The third factor in our initial studies had repeated itself with stubborn regularity: Certain women attending the clinics seemed to produce

more than their share of infant deaths and related morbidity and mortality. To find the problem cases on which to concentrate preventive efforts, we designed a screening device that combined a maternity record and a score sheet on which to grade the pregnancy risk of the mother and the survival risk of the fetus.

Maternity Record

The maternity record is still undergoing trial in the prenatal clinics. It is designed so that grades of "good," "fair," or "poor" risk are given in each of seven major sections: (a) mother's previous obstetrical history, (b) her previous medical history, (c) the family history, (d) the mother's diet, (e) physical examination (including pelvic evaluation), (f) laboratory and X-ray findings, and (g) subsequent antepartum visits. The total risk for each patient is based on the grades in each of these respective sections.

At the close of each clinic session, nurses review and grade each patient on the major sections of the record. Patients graded "fair" or "poor" are selected for more frequent visits to the prenatal clinics and for intensive followup through home visits by the nurses.

The following outlines from two sections of the trial maternity record illustrate the grading system.

Previous Obstetrical History. A grade of "good" is given to the patient whose previous obstetrical history is essentially negative. A grade of "fair" is based on any one or a combination of the following factors:

1. Seven or more deliveries.
2. One abortion.
3. A history of any single complication other than toxemia; for example, hemorrhage (antepartum) or mild hypertension.
4. One premature child living or dead, 1 fetal death, or 1 infant death.

A grade of "poor" is based on any one or a combination of the following criteria:

1. Cesarean section.
2. Two or more abortions.
3. History of toxemia.
4. History of 2 or more other complications.
5. Two or more premature children living or dead, 2 or more fetal deaths, or 2 or more infant deaths.

6. A combination of 2 or more abortions, premature births, fetal deaths, or infant deaths.

Physical Examination. A grade of "good" is given to the patient in good general condition with essentially negative findings on her physical examination. A grade of "fair" is given when the physical examination reveals the following conditions:

1. More than 20 percent overweight.
2. Blood pressure 140/90 or above.
3. Edema of the feet.
4. Inactive tuberculosis.
5. Any other condition or combination of conditions that, in the examining physician's judgment, would grade the patient's physical condition as fair.

A grade of "poor" is justified when these conditions are present:

1. A combination of elevated blood pressure, increased weight, and edema.
2. Hypertension 150/100 or above.
3. Active pulmonary tuberculosis or syphilis.
4. Edema of the feet and hands, or edema of the face, or both.
5. Organic heart disease.
6. Marked deformity of the spine.
7. Breech presentation.
8. Serious change in the fetal heart rate such as inability to hear the fetal heart sounds.
9. Contracted pelvis or any other serious deficiency in the pelvic measurements.
10. Any other condition or combination of conditions that, in the examining physician's judgment, would grade the patient's physical condition as poor.

Grade of Risk

The final calculation of the grade of risk for each patient is based on these criteria for "good," "fair," and "poor." It must be emphasized that the grading is influenced by local conditions.

Good. A patient whose maternity record is essentially negative in all seven sections is graded a good risk.

Fair. Grades of "fair" for the sections on previous obstetrical history and physical examination or the section on laboratory and X-ray findings would automatically grade the patient as a fair risk. A grade of "fair" in two or more of the remaining sections, namely, pre-

vious medical history, family history, and diet, would give the patient a grade of risk of "fair."

Poor. A grade of "poor" for the section on previous obstetrical history and the section on physical examination or the section on laboratory and X-ray findings would automatically give the patient a grade of risk of "poor." A rating of "poor" in two or more of the other sections would give the patient a grade of "poor."

A sudden increase in weight or blood pressure, the appearance of significant edema, bleeding, any other significant findings, or a combination of conditions might warrant, of course, a change in the grade of risk under the section on antepartum visits.

Although from a first glance the grading system might appear cumbersome and complicated, I hasten to add that, after a relatively short period of working with the record, nurses and clinicians are able to evaluate the patients with speed and accuracy. The record serves not only to select patients of special risk but also to emphasize to our clinic personnel those factors which are of major significance in the prognosis of the prenatal patient.

Evidence of Decline

My purpose has been to review a purely local approach to a specific local public health program. I have attempted to suggest that even when outside help is not available on a grand scale and the local resources and facilities are limited there is still a great deal that can be accomplished by applying the fundamental tools of public health.

Although there has been a decline in pertinent rates, we feel that the program should be continued for a longer period of time before attempting an analysis of these data.

Lest I may have given the impression that Halifax County's approach to the problem of fetal wastage is a final solution, I wish to emphasize that our experience underlines the need for more intensive investigation of the unknown factors.

• • •

Samples of the forms described are available from the Halifax County Health Department.

Legislation on Air Pollution

By FREDERICK S. MALLETT

THERE IS considerable evidence to show that today the forms and degrees of air pollution are demonstrably worse than ever in human history. The causes of this increase in pollution are, briefly: the tremendous growth of population in our cities, owing to both migration and birth rate; the enormous increase in numbers of automobiles, trucks, and buses and their associated exhaust gases; the incineration of vast volumes of rubbish; the combustion, both domestic and industrial, of megatons of fuels; and the great expansion of manufacturing processes of all kinds, resulting in new and, as yet, uncontrolled effluents.

The atmospheric sewer is backing up and, like a swarming bacterial colony, we are beginning to suffer from the accumulation of our own wastes.

To control the atmospheric byproducts of modern civilization, we have turned to a good old-fashioned remedy, the law. We are trying, at the moment, to legislate air pollution out

of existence. The solution to the problem is not quite so simple.

Modern Legislation

Most early laws and ordinances dealt with smoke only; fly ash or soot appeared in the picture somewhat later. In this country, the earliest recognized instance occurred not quite 100 years ago, when an 1864 lawsuit in St. Louis resulted in a judgment declaring smoke to be a nuisance. This action was followed 3 years later by adoption of an ordinance requiring that the chimneys of all manufacturing establishments be at least 20 feet above the adjoining buildings.

Chicago adopted its first smoke ordinance in 1881. This provided that the emission of dense smoke "shall be a public nuisance." No definition of smoke or of its density was given.

A 1912 survey by the United States Bureau of Mines found that 12 cities with a population of less than 50,000 had either a smoke ordinance or a smoke inspector and that about 19 cities of 50,000-200,000 were active in the suppression of smoke. Of the 28 cities with more than 200,000 population, 23 showed activity.

Contra Costa County, Calif., in 1915, adopted an ordinance restricting "fume" strength as an outgrowth of the Selby smelter problem. However, the first countywide legislation and enforcement appeared in Hudson County, N. J., in 1931.

The first State legislation appeared in 1909 in Rhode Island, covering smoke emission in cities over 150,000 population. Domestic

Mr. Mallett is a consultant on air pollution problems and is also executive secretary of the Committee on Air Pollution Controls, the American Society of Mechanical Engineers. He formerly was associated with the Public Health Service Occupational Morbidity and Mortality Study, 1935-37, Detroit. Mr. Mallett's original paper, which was somewhat longer, was presented before the 18th annual meeting of the American Power Conference, sponsored by the Illinois Institute of Technology and held at Chicago, March 21-23, 1956.

sources were exempted, as were locomotives at the time of starting and feeding fires while in roundhouses or yards.

Massachusetts, in 1910, introduced in its smoke control law a device for estimating smoke density which is still extant, namely, the Ringelmann chart. The chart was devised in the 1880's by a French professor of agricultural engineering and was first used in this country in 1899. With all its shortcomings, it is still widely used although several other devices have been introduced. The model ordinance published by the American Society of Mechanical Engineers, which has formed the basis for most municipal smoke abatement ordinances in this country, includes the Ringelmann chart.

For a number of years, New Jersey and metropolitan New York have been disturbed by interstate air pollution. Bills were introduced in the legislatures of both New Jersey and New York to institute an interstate survey, but until 1955, when New Jersey finally passed a matching bill, these had been passed only by New York. The New Jersey bill provided for an investigation of the area in question to determine whether an interstate air pollution problem exists and, if so, to recommend appropriate controls, an agency to apply them, and to suggest the draft of legislation necessary to implement the findings.

The Interstate Sanitation Commission was directed to undertake the study, for which New York and New Jersey each provided \$30,000. The terminal date for the presentation of findings and recommendations was set for February 1956. However, the investigation has been delayed because of legal complications over jurisdiction.

A joint resolution by both houses of the Congress signed August 3, 1956, by the President, approves the present bi-State arrangement in which the State of Connecticut, the third member of the Interstate Sanitation Commission, has acquiesced. Bills have been passed by both the New York Legislature and the New Jersey Assembly, updating and approving the commission's plans for proceeding.

Both Canada and the United States have shared concern over air pollution in two areas: one at Trail, B. C., from 1928 to 1935, and the other at Detroit, Mich., and Windsor, Ont., since

1950. The International Joint Commission undertook the Detroit-Windsor investigation, which originally was concerned with smoke from the vessels traversing the Detroit River. This joint interest in smoke control has been expanded into a comprehensive study to determine the effect of air pollution on almost every aspect of community life.

Local Accomplishments

St. Louis was probably the first large city to make an effective reduction in smoke pollution. Before 1940, particularly in the winter, dense smogs were frequent occurrences. It was not uncommon there to have lights and headlights burning until noon. Now there is acceptable evidence to prove that a marked reduction in smoke pollution has been brought about by the city.

Essentially, this improvement was achieved through enactment and enforcement of an ordinance prohibiting the sale of high volatile coal in the city except in sizes under 2 inches. It was also required that all bituminous coal containing over 12 percent ash or 2 percent sulfur be washed.

Allegheny County

For many years, efforts at smoke control in Pittsburgh had such little success that the place was widely known as the "Smoky City." Residents of Pittsburgh can truly testify to the density and irritating qualities of the "black days." Until the late 1940's, Pittsburgh was deteriorating in every way, but finally a great civic movement—the Allegheny Conference on Community Development—arose to resuscitate the decaying city. It was the force behind this great effort which brought about the change in the Pittsburgh atmosphere.

The details of the city of Pittsburgh and Allegheny County ordinances are too complex for a brief discussion. Based in large part upon the St. Louis ordinance, these ordinances brought about a marked reduction in the smoke content of the air, principally by increased inspection and enforcement and by restricting the volatile content of solid fuels. It should not be assumed, however, that a miracle has occurred and that there is no pollution left to be con-

trolled in Pittsburgh and Allegheny County: quite the contrary. Nevertheless, a truly remarkable improvement has been achieved. There are many technical problems left to solve, but, at least, attention is being given them. Under study are effective and economical control methods—especially for steel processes—which may replace conventional and costly equipment presently available.

Los Angeles County

Los Angeles' smog began to appear as a serious problem during the industrial expansion and population growth of the World War II period. More than \$1 billion in new capital was invested from 1941 to 1950, and more than 5 million people were added to the population of Los Angeles County. People began to be aware of an irritation of the eyes and respiratory tract. This smarting of the membranes and lachrymation were associated with the presence of a noticeable haze. Two other features of the smog, whose relationship was not learned until later, were damage to vegetation, especially certain truck garden crops, and accelerated cracking of rubber, most noticeable in the sidewalls of tires.

Insistent public demand brought about the passage, in 1947, of a State enabling act which created control districts to be activated by any county that determined control to be necessary. At least 4 California counties have active districts, and several other districts have been authorized; there is one authorized 9-county group in which 6 counties are organizing.

The California State enabling act specifically and generally prohibits air pollution and provides for the establishment of local rules and regulations by each control district. Those of the Los Angeles Air Pollution Control District provide a permit system for both construction and operation of any equipment which may cause emission of air contaminants. Detailed plans and specifications must be filed before permits are granted for new construction or modernization. Under these provisions the district engineers have approved permits for well over \$100 million, of which over 15 percent is for control equipment. The rules also apply restrictions for specific pollutants such as

particulate matter, sulfur gases, and the solid products of combustion in excess of certain concentrations.

The Los Angeles County Air Pollution Control District, the enforcing body, has had a harried history. Although smog may occur during any month of the year, it is most prevalent during the late summer and the autumn and may even extend through December into January, as it did in 1953. In 1954, a 17-consecutive-day episode occurred during which public protest became uproarious. The board of county supervisors—the governing body—reorganized the agencies, providing for enforcement by strenuous prosecution. So many violations were cited that a special smog court was set up. However, in spite of the vigorous enforcement effort, on September 13, 1955, the worst smog ever recorded occurred. The lesson to be learned from the situation is that the problem of urban air pollution should be tackled in its potential state rather than when it becomes an actual and serious problem.

Other California Developments

Two events in southern California are noteworthy. The first is the use of the Ringelmann chart to judge the opacity of plumes composed of other than black smoke, the original purpose for which the chart was devised. The other is the refusal of an operating permit for a steam power station because, among other reasons, of the high sulfur content of the fuel which it proposed to use.

Early in 1955, local courts affirmed violations of the opacity sections of the Los Angeles regulations wherein plumes of blue, yellow, or even white effluents were judged by inspectors making a mental translation of the Ringelmann chart. The United States Supreme Court has since refused to review, in effect thus supporting the finding.

In the other instance, the El Segundo station of the Southern California Edison Company was refused an operating permit on the grounds of the high sulfur content of the fuel proposed for use and of the inability to reduce the opacity of its plumes. Construction permits for additional proposed steam stations were also refused. As a result, the company has under-

(Continued on page 1073)

Public Law 159—84th Congress

“... it is hereby declared to be the policy of Congress to preserve and protect the primary responsibilities and rights of the States and local governments in controlling air pollution, to support and aid technical research to devise and develop methods of abating such pollution, and to provide Federal technical services and financial aid to State and local government air pollution control agencies and other public or private agencies and institutions in the formulation and execution of their air pollution abatement research programs. To this end, the Secretary of Health, Education, and Welfare and the Surgeon General of the Public Health Service (under the supervision and direction of the Secretary of Health, Education, and Welfare) shall have the authority relating to air pollution control vested in them respectively by this Act.

“The Surgeon General is authorized, after careful investigation, and in cooperation with other Federal agencies, with State and local government air pollution control agencies, with other public and private agencies and institutions, and with the industries involved, to prepare or recommend research programs for devising and developing methods for eliminating or reducing air pollution. For the purpose of this subsection the Surgeon General is authorized to make joint investigations with any such agencies or institutions.

“The Surgeon General may (1) encourage cooperative activities by State and local governments for the prevention and abatement of air pollution; (2) collect and disseminate information relating to air pollution and the prevention and abatement thereof; (3) conduct in the Public Health Service, and support and aid the conduct by State and local government air pollution control agencies, and other public and private agencies and institutions of technical research to devise and develop methods of preventing and abating air pollution; and (4) make available to State and local government air pollution control agencies, other public and private agencies and institutions, and industries, the results of surveys, studies, investigations, research, and experiments relating to air pollution and the prevention and abatement thereof.

“The Surgeon General may, upon request of any State or local government air pollution control agency, conduct investigations and research and make surveys concerning any specific problem of air pollution confronting such State or local government air pollution control agency with a view to recommending a solution of such problem.

“The Surgeon General shall prepare and publish from time to time reports of such surveys, studies, investigations, research, and experiments made under the authority of this Act as he may consider desirable, together with appropriate recommendations with regard to the control of air pollution.

“There is hereby authorized to be appropriated to the Department of Health, Education, and Welfare for each of the five fiscal years during the period beginning July 1, 1955, and ending June 30, 1960, not to exceed \$5,000,000 to enable it to carry out its functions under this Act and, in furtherance of the policy declared in the first section of this Act, to (1) make grants-in-aid to State and local government air pollution control agencies, and other public and private agencies and institutions, and to individuals, for research, training, and demonstration projects, and (2) enter into contracts with public and private agencies and institutions and individuals for research, training, and demonstration projects. . . .

“When used in this Act—

“The term ‘State air pollution control agency’ means the State health authority, except that in the case of any State in which there is a single State agency other than the State health authority charged with responsibility for enforcing State laws relating to the abatement of air pollution, it means such other State agency;

“The term ‘local government air pollution control agency’ means a city, county, or other local government health authority, except that in the case of any city, county, or other local government in which there is a single agency other than the health authority charged with responsibility for enforcing ordinances or laws relating to the abatement of air pollution, it means such other agency; and

“The term ‘State’ means a State or the District of Columbia.”

taken a \$1.75 million research program to find, hopefully, the answers to its difficulties.

Federal and State Legislation

Several attempts at Federal legislation on air pollution followed the 1948 catastrophe in Donora, Pa. Last year, for the first time, there was major national legislation on this problem. Pertinent sections of Public Law 159 (84th Cong.), which became effective on July 14, 1955, are reproduced in the inset.

In general, Federal legislation aims toward research, cooperation with local agencies, and financial assistance to other groups rather than in the direction of enforcement. In some of these fields the Federal Government is already active. Early in 1955, the Public Health Service intensified its program of air pollution research and technical assistance to State and local agencies at the Robert A. Taft Sanitary Engineering Center, Cincinnati.

It is difficult to keep track of all statutes pending in State legislatures. However, at least 70 bills were considered by 12 State legislatures in 1955, but the number may well be 100. Almost 40 of the 70 bills were before the California Assembly. They provided, among other things, for the amplification of the present law for the formation of county air pollution control districts, for the creation of regional control districts, or for statewide control. One bill, passed to remedy the problem in the San Francisco Bay area, permits the creation of the 9-county district mentioned previously.

New Jersey passed a State air pollution control statute in 1954. Enforcement under this act has been in the hands of the bureau of adult and occupational health of the State department of health. Codes covering various air pollution problems are being formulated by the Air Pollution Control Commission, a body representing industry, the general public, the technical societies, and other responsible groups in New Jersey. The commission recently completed work on its first code—on the control of open fires and dumps, which are major sources of air pollution in the northeastern section of the State. The code went into effect May 1, 1956, and affects scrap dealers and others with unsatisfactory incinerators.

Other States which considered air pollution legislation in 1955 were Arizona, Michigan, and Virginia. The Michigan bill would create air pollution control districts. Virginia's and Arizona's bills were for statewide authority. One bill in the Arizona House of Representatives went to the extreme of proposing to prohibit "the construction of oil refineries or other smoke-producing industries within 15 or 20 miles of any city or town."

Municipal and County Control

The tendency, in recent years, to convert from coal to oil or gas as a domestic fuel is helping to reduce smoke in urban atmosphere, but it does not completely eliminate it. A poorly adjusted oil burner can lay down a smoke screen worthy of a naval operation. Furthermore, high-sulfur oils contribute large quantities of sulfur dioxide to the atmosphere.

So many cities and towns have recently adopted or are presently considering smoke abatement or air pollution control ordinances that it is almost impossible to keep track of them. To mention a few:

Reno, Nev., Huntington and Wheeling, W. Va., Albuquerque, N. Mex., East Providence, R. I., Denver, Colo., Boyertown, Pa., Norfolk, Va., and Fair Lawn Borough, N. J., have all adopted new ordinances. Cleveland, Ohio, is modifying its present ordinance, and Charlotte, N. C., is reviving its old ordinance.

These are only isolated examples. However, the pattern of municipal legislation is much the same. In the absence of expert technical guidance, most local governmental bodies perforce use the scissors-and-paste method. They base their new ordinances on those of nearby or well-known cities or occasionally utilize so-called "model ordinances."

The typical city smoke control ordinance is relatively simple. It provides for the prohibition of black smoke of a given density (usually No. 2 Ringelmann) and forbids the emission of fly ash of a certain concentration (usually not exceeding 0.85 lb. per 1,000 lbs. of gases).

There is a trend, however, toward broader municipal air pollution control ordinances, based on the Los Angeles County ordinance as a model which prohibits the emission of all toxic

and nuisance effluents, with even specific levels for certain gases such as sulfur dioxide.

One of the most noticeable results of the Los Angeles smog activity has been a tendency for other areas to copy its regulations. Honolulu, Hawaii, is one; Louisville, Ky., was another, but then abandoned the idea and is presently embarked upon a comprehensive air pollution survey.

Elsewhere across the country there are current efforts to emulate the California model county control districts.

The county control-district type of air pollution agency will be more prevalent in the future. It solves the problem of control in the large city that is unable to control smaller, neighboring suburbs. For similar reasons interstate compacts probably will be employed to handle the problems faced by New York with pollution drifting from industrial New Jersey, by St. Louis with pollution drifting from the adjacent industrial areas across the river in Illinois, by Cincinnati with pollution from Kentucky communities, and by many other cities.

Cost of Control

The control of air pollution is not going to be cheap. In fact, it is going to be expensive. The cost of providing pure water or good sew-

age disposal was high in dollar outlay although not in relation to the advantage gained. It will be the same with pure air. But, as with water and sewerage costs, the outlay may be less than the cost of continuing pollution. This consideration provides the opportunity for a carefully planned program of education.

In many communities, educational programs are being assumed by the chambers of commerce. Programs may be undertaken by a college or university or in some areas by research organizations, such as Stanford Research Institute of California with its series of air pollution symposiums, Mellon Institute of Pittsburgh with its Industrial Hygiene Foundation meetings, the Air Pollution Foundation, the Southern Research Institute, and others.

Research organizations can aid also in the development of community educational programs by bringing to air pollution control a scientific and impartial point of view. Surveys and other studies will help in determining whether a pollution problem is real and whether the health considerations are transitory and superficial or chronic and basic. Research projects can be set up to study the nature of air pollution and how it can be best eliminated or controlled. These great economic, technological, and social issues challenge the statesman and legislator no less than the industrialist, scientist, and engineer.

Mintener Resigns



Mr. Mintener

"It is a matter of deepest regret to me and, I know, to all my associates in the Department, that Bradshaw Mintener is resigning his position as Assistant Secretary of Health, Education, and Welfare.

"In the two years Mr. Mintener has held this post, he has made a great contribution to the work of this Department. The fine spirit of our organization, particularly in the field, is due in large measure to his activities. His sound advice on the problems of the Food and Drug Administration has been instrumental in laying a proper foundation for a greatly needed expansion of its activities which are so vital to everyone in the Nation.

"I am sorry Mr. Mintener could not stay longer in Government service."

—MARION B. FOLSOM,
Secretary of Health, Education, and Welfare.

Group therapy at the National Training School for Boys brings out into the open the warfare delinquents wage against adult society and the fears and hungers underlying it.

Group Therapy Behind Locked Doors

By SEYMOUR RUBENFELD, Ph.D., ROBERT SHELLLOW, Ph.D., and JACK L. WARD, M.D.

TO GIVE the reader some idea of the functions of the psychiatric unit in a juvenile institution, as well as some feeling for the types of problems faced in working with these youngsters, we shall attempt to describe the unit in the National Training School for Boys. The training school is for delinquent boys under the age of 18 who have been committed to the custody of the United States Attorney General. The school is operated in the District of Columbia under the auspices of the Federal Bureau of Prisons. We three, a psychiatrist and two clinical psychologists, form the psychiatric unit.

The authors are the three members of the psychiatric unit which they describe. Drs. Rubinfeld and Shellow, the two psychologists on the staff of the National Training School for Boys, Washington, D. C., received their graduate degrees from Pennsylvania State University and the University of Michigan, respectively. Dr. Rubinfeld interned at Warren State Hospital and Hollidaysburg State Hospital in Pennsylvania. Most of Dr. Shellow's earlier experience was with Veterans Administration hospitals at Ann Arbor, Dearborn, and Fort Custer, Mich. The third member, Dr. Ward, spent his internship and residency years at Delaware Hospital, Wilmington, and St. Elizabeths Hospital, Washington, D. C., before he was appointed acting chief of the NTS Psychiatric Service on April 1, 1955.

First of all, it is important to know what kinds of boys get into trouble and are sentenced to an institution of this type. Roughly, the boys with whom we deal fall into four categories.

Probably the most prevalent type is the boy we might call the predatory delinquent. His socioeconomic background is, more often than not, one of deprivation. His own family is usually large and disorganized. He may have experienced several foster home placements. The parental figures he has known may have bombarded him with the deepest kinds of rejection, ranging from exploitive overprotectiveness through cold indifference and neglect to sadistic hostility. He emerges from this trial of childhood with his ability to accept his dependence on others severely crippled. Estranged from adults, he sees them as persecutors. He throws himself against both adults and the social values and mores to which they conform. Adrift in the streets, he imbeds himself in the society of other adolescent outcasts. Here, he finds firm and uncompromising articles of conduct, the rules of the delinquent gang that sanction and codify ways of vengeance and means of exploitation.

Falling into a second group are boys who get into trouble for neurotic reasons. Many come from the middle class and often from upper middle-class socioeconomic backgrounds. Their families are frequently intact and may even be relatively well knit. These boys have

to some extent incorporated the moral standards of the rest of society but feel themselves driven to violate their own consciences. The reasons, of course, are many and complex, ranging from self-defeating tendencies within the boy to conscious and unconscious rebellion against parental expectations. When seen at this institution, these boys are usually worried. They are somewhat more approachable than the predatory delinquent and seem to bring with them vestiges of identification with and acceptance of adults. Many of these boys show more conventional symptoms of deviant behavior: bedwetting, fingernail biting, periodic depressions, and general anxiety.

The third type of boy is known in psychiatric parlance as "an inadequate personality." The familiar term "fall guy" expresses the way this boy behaves interpersonally. Sometimes unintelligent but not always so, sometimes, but not inevitably, of a rural background, he lacks initiative and makes his way by giving in. More than anything else, he wants to be cared for, and in order to win acceptance from his peers, he follows their lead. Often, when he is no longer useful, he is deserted. He is left to "take the rap."

Boys in our fourth category are not seen so often as the others, but they form a distinctive group. They are the psychotics. On occasion, a boy may enter the institution with no clear history of such disorder, and, after some time, he begins to show symptoms of graver forms of mental illness.

Methods of Treatment

Much of the psychologists' time, and some of the psychiatrist's, is spent in identifying these boys as they come into the institution. All boys are seen by the psychologist during the initial 30-day period of orientation prior to their entrance into the institutional program. Each boy's position on a number of different dimensions of ability is determined for the purpose of finding the most suitable rehabilitation program at the school. This is accomplished by obtaining test measures of the boy's intellectual and manual dexterity capacities. Boys are tested in groups. If at any time there is suspicion that the group test was not a valid

estimate of the boy's intellectual potential, he is scheduled for an individual reevaluation. Often boys do not take the group tests seriously enough to concentrate successfully on the task. Some boys who have never been tested before become anxious, and this anxiety interferes with their performance.

In addition to employing these measures of ability, the psychologist sees groups of newly admitted boys in an attempt to screen out those who will find it difficult to adjust to institutional life, those who will be the troublemakers, the leaders, and those who evidence signs of serious emotional disorders. The boys, in groups of 5 to 8, are given the House-Tree-Person Test, a simple projective drawing device. A seemingly innocuous test, the H-T-P taps each boy's unique method of approaching the world. Emotional needs and how he meets these needs are projected onto a blank piece of paper. Following this, the psychologist conducts a group interview. He tries to evoke expressions of personal attitudes and opinions from each group member. Usually, the boys talk about their anticipations and their fears concerning the institution, and they often brag about their exploits. Heated and frank exchanges often result. The group interview is taken as a work sample of how each boy will react when placed in the larger group of his cottage.

On the basis of this group interview and the projective test data, certain boys are referred to the psychiatrist for interview and for more intensive psychiatric study. If the psychiatrist has more questions about a boy's method of adjustment, he may arrange for him to be given more comprehensive projective testing. The group interview serves also as a means for picking out boys who look like good prospects for either individual or group therapy. If it appears that a boy might benefit from a close or intensive relationship with an adult, we consider him for individual therapy. In addition to these cross referrals within our own unit, boys are referred to us by the professional staff sitting as a review committee and by the correctional officers, the superintendent, the assistant superintendent, and others on the staff who spot boys who are having particular trouble in getting along.

We serve as consultants to the people who

have to deal with these boys 24 hours a day. We attempt to supplement their understanding of the boys and offer suggestions for the handling of specific behavior problems. Occasionally, certain incidents occur which demand unusual consideration. For example, a boy may evidence a frank psychotic break, and it is necessary to transfer him to a psychiatric hospital.

Recently, we have been placing a small number of disturbed boys on mood-ameliorating drugs such as Thorazine and Meratran. These boys usually show obvious anxiety or some degree of depression as an aspect of their general poor adjustment in the institution.

Our major treatment effort is invested in group psychotherapy. Many acting-out adolescents are not amenable to individual psychotherapy. These boys immediately react in an uncritical and uncontrolled fashion to inner promptings. This basic one-to-one relationship is too threatening for them. Firmly embedded in their personality is overwhelming distrust of the adult and fear of losing their fragile identity. They seem to function better in a group. Many of them find support, strength, and comfort in a gang formation. The adolescent urge to conform can, in the group setting, be utilized by the therapist in working toward the therapeutic goal of self-examination and self-evaluation.

By using the group treatment process, we now see 45 boys in 5 groups, each consisting of 5 to 10 members. We try to keep about 8 boys in each group, finding that this number allows for the development of opposing factions within the group itself. Smaller groups do not appear to be so successful because they tend to be more clannish. For example, 4 boys may form their little clique in a group of 5 and completely drown out the lone dissenting voice. Larger groups are unwieldy and difficult to control.

Getting a New Group Under Way

In selecting candidates for group therapy, we again employ the technique of the group interview. We call together anywhere from 8 to 10 boys, evoke response, encourage interchange of ideas, and observe the role that each adopts toward us and toward the other boys. In the course of the discussion, we explain our pur-

pose, outline the aims and the nature of group therapy, and leave to the individual boy the choice of joining.

We avoid taking into therapy boys who make absolutely no effort to contact adults. We have found that they are not interested in group therapy, and, if they do enter a group, they get little out of it and soon leave it. We also avoid bringing in boys who have a compulsive need to act out their slightest whim or fear. We have had trying experiences in which these extremists continually disrupt groups and bring therapy to a stop.

But we have no objection to acting-out if it is checkable. It is one of our basic stocks in trade. Almost all our boys display this characteristic to some degree, and we work with it. All we require is that a boy, in addition, have some capacity to think and to speak in the face of his own anxiety or frustration and that he be ready to admit that he has questions about himself.

Boys come to the groups voluntarily. If they are interested in joining after the group interview, we take them in on the condition that they will remain at least 1 month or for 8 sessions. If at any time they decide to leave, if they feel that they are not getting anything out of it, we usually ask them to continue for 2 or 3 sessions after they have requested termination.

What are the boys who come into group therapy like? First and foremost, they have an arsenal of suspicions concerning adults and in particular the therapist, who becomes the momentary focus for those concealed and sometimes overtly expressed attitudes. Each boy has his fallen god or goddess. The boys remember the disappointing experiences they have had with adults. They remember the inconsistency of treatment and the inability of adults to control them. The result is that they bring to any relationship with an adult a tremendous amount of hostility—a hatred and a vengefulness which are clouded and confused by strong needs for direction, guidance, and love.

One way in which this hostility is expressed can be seen in a boy's comments in his first group therapy session: "Why did you choose me? Why not leave me alone—I'm not crazy."

Later, this suspiciousness may show up as:

"Why do you do this, Doc? What's in it for you? You must be a spy—it all gets back to the superintendent." Or: "You're just experimenting with us . . . nobody really gives a — about us. You bucking for Captain?"

It has been our experience that these attitudes are present in all boys but become expressed in various forms by different members of the group.

Use of Group Dynamics

From the preceding description it may appear that there is an incessant war of boys against therapist. As a matter of fact, when one faction of the group becomes intoxicated with the power of their anti-"Doc" attitudes, others in the group will begin to defend authority and attempt to stem the tide of violence. At this point a polarity is set up within the group: Struggle for power or a civil war develops along the lines of a personal duel or of gang warfare.

The polarity emerges because of the deep hungers for an infantile protective relationship with the therapist and because of the resentments stirred in the more aggressive boys when the therapist does not offer this relationship. The group splits into factions because some boys can't afford to see the therapist attacked. The boy who is driven to defend the therapist when he sees the attack launched is afraid that the therapist will attack him. Despite this apparent alliance with the "Doc," the boy's reaction is still based on the fact that he has identical, though not quite so obvious, feelings against the therapist's authority.

The therapist, with his relative understanding of the situation, is generally not incapacitated by anger with those attacking him or taken in by those defending him. Attempting to recognize both of the antithetical reactions for what they really are, he bases his comments and interventions on the insight derived from his own natural responses. He stands his ground and attempts to lead from strength. As therapist, all his interventions are directed toward clarifying to the entire group the issue of their basic struggles with dependence.

The group dynamics described in the preceding paragraphs are probably best seen in the

actual transactions and interactions of a group therapy session.

A Group Therapy Session

John has stolen 17 cars, was in 2 previous institutions, and makes his way by gambling, "conning," and setting up "strong arm" cliques to get what he wants. At the moment he has the center of the stage. He tells about a movie the boys saw on television in which a man paroled from prison can't make a go of it in society. Nobody will give the ex-convict a job; his friends avoid him; and jobless, friendless, discriminated against, he gets drunk one night and gets returned to the prison as a parole violator.

As John gets more and more worked up about the injustice of it all, George and Sam go from quietly ignoring the group in their card game to sparring and light body punching. Peter and Ritchie are quietly listening and watching the therapist's reaction.

The therapist notes John's involvement and says, "Well, John, you seem to feel that was a pretty dirty deal."

For the first time, John centers a challenging gaze on the therapist. "You're — right this was a dirty deal. Nobody ever gives a guy who has done time a chance."

"How come?" the therapist asks.

"They're all down on a guy like that, they hate his guts. They don't let you alone when you're on parole. You're just sitting on your porch, and the cops keep coming around your house every night, and they're always frisking you . . . they're always needling you."

George turns aside from his sparring and throws out, "And they're all like that, whether they're inside the prison or outside."

The therapist says in an offhand way, "You seem to feel that people are down on you."

At this point, John bursts out, "You said it, Daddy-o," and goes on to tell how a cottage officer "threw" him into a segregation unit for what John considered to be an unjust reason. George and Sam join in. They break off their sparring and recount similar "mistreatment."

The therapist turns to the boxers. "George . . . Sam, you seem to be getting hot under the collar about this too."

John snaps to them, "Aw, don't listen to him (the therapist). He doesn't really give a — either."

The whole group is stunned by this statement. George and Sam snicker uneasily. The therapist tries to get John to amplify his feeling, but before he can get more direct expression of hostility, the group slides deftly away and begins talking about custodial officers in general. The session ends with general griping about the institution.

The next session starts with John mischievously asking the therapist for a cigarette. When the therapist questions John about his relentless nagging for the cigarette, John blows up. "All the time you're asking why, why . . . we never get anything out of you." John suddenly sees himself as the anti-"Doc" hero, and it is obvious that he is enjoying the situation. He and George and Sam begin to giggle. John calls the Doc a "squealer" and accuses him of spying and making reports on everybody in group therapy. "You're yellow, Doc. You don't have any guts at all. You wouldn't last twenty minutes in prison."

Meanwhile, the therapist has observed Ritchie and Pete, among others in the group, no longer looking scared. On the contrary, Ritchie seems to show signs of "righteous indignation" at John's last statement. Ritchie says under his breath, "Aw, —."

The therapist notes Ritchie's reaction and says, "Group, what do you think of what we are hearing?"

Ritchie says derisively, "Don't listen to him, Doc, he's way off."

John turns on Ritchie with vengeance. "Who asked you, Punk? You're always eating somebody. What do you know about anything? You're just a clock (newcomer). You haven't met your six-piece yet (6 months' reclassification at which a boy can request a change in program)."

By this time, the lines of the battle are clearly drawn. Pete sides with Ritchie, and George with John. Others lean forward attentively. Ritchie counterattacks against John. "You're just taking it out on the Doc because you were stupid enough to get thrown in the jug. You always do this. Whenever you foul yourself up, you always blame it on somebody else."

At this point Ritchie and Pete begin to cite instances of John's asking for trouble, getting into it, and blaming others.

John retaliates by describing situations in which Ritchie has gotten away with things by "eating" (apple polishing) the officer and implies that Ritchie is trying to do that now with the therapist. The therapist says, as quietly as possible, "I guess someone wants to kick me, and someone else wants to suck me in, but it's pretty hard to tell who wants to do what."

The group goes suddenly quiet, and there is embarrassed laughter on both sides. John nervously tries to maintain his lead and at the same time turn the therapist aside. "Aw, Doc, we were only kidding, we were just trying to get your goat."

The therapist asks, "I wonder why?"

At last, John hits on a way to retreat without loss of face. "Here we go again: What, Why, When, Where. If the Doc was running 'You Asked for It' on TV, he would read the letters and then look out at the audience and say, 'Why should I?'" This amuses the group. Tension is broken, and the group as a whole runs from the dangerous challenge given by the therapist into humorous accounts of instances in which the question "Why?" would be ridiculous. The session ends with the therapist remarking, "I guess you'll be comfortable enough eventually to talk about yourselves."

Clues to Delinquent Behavior

The conflict between members and therapist, and among members, comes up again and again in different contexts. Sometimes the therapist is successful in focusing on the feelings and disappointments the boys have experienced with their parents and other significant people in their past life. When this happens, he attempts to relate their feelings to the feelings they are experiencing toward authority in general and toward the therapist in particular.

Movement in and out of such crises is characteristic of our groups. The group is like a self-sealing innertube: Occasionally a boy or the therapist succeeds momentarily in puncturing the resistance of the group, and powerful feelings explode before the wall of denial fuses again. Through repetition of this kind of

crisis, there is a gradual sharpening of a boy's image of himself and a lessening of his hate. As he grows more comfortable with himself, he finds it less frightening to stand alone, and the need to blame and hate others for his own inadequacies abates. He is able to stand apart equally from attacks on, and defenses of, the therapist by the less advanced members of the group, and he can criticize both sides. He begins to talk openly about the personal consequences of his own experiences, and he begins to lay realistic plans for his future.

Group therapy not only provides a workable vehicle for effecting change in these adolescents

but also supplies many clues to the nature of the developmental processes producing delinquency. The reader may have observed that most of the diagnostic and therapeutic tools which we employ are not at all new. The interviews, diagnostic tests, and the therapeutic relationships are much the same as those used in the conventional psychiatric setting. We are entirely content with these techniques because, as yet, our knowledge of the delinquent is far from complete. The evaluation of our skills must wait upon the direction of resources toward a systematic observation of the rebellious adolescent.

PHS Films

Flocculation Test for Trichinosis

35 mm. filmstrip, color, sound, 11 minutes, 85 frames, 1956.

Audience: Laboratory directors and experienced laboratory technicians.

Availability: Loan—Communicable Disease Center, Public Health Service, 50 7th Street NE., Atlanta 5, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

The use of the modified bentonite flocculation test is the subject of this highly technical procedural film-



strip. It is a simple, rapid, and specific test for the laboratory diagnosis of trichinosis.

The film depicts the materials

used and the complete procedures for the test, including reconstitution of the bentonite, preparation of the antigen, standardization of the reagents, and typical appearance of the flocculated particles.

Poultry Hygiene Series: Plant Layout and Construction Operating Procedures

35 mm. filmstrips, color, sound, 10 minutes each, 73 and 83 frames, respectively, 1956.

Audience: State sanitarians, public health administrators, and plant operators.

Availability: Loan—Communicable Disease Center, Public Health Service, 50 7th Street NE., Atlanta 5, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

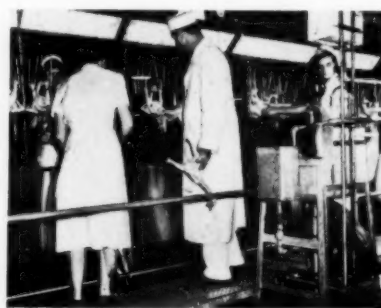
These two films show the application of the 1955 United States Public Health Service Ordinance



and Code to (1) the construction and layout of a medium-sized plant and (2) operating procedures.

The first film is illustrated by a blueprint of a plant showing five main divisions: (a) receiving and holding room, (b) dressing room, (c) eviscerating room, (d) packaging room, and (e) refrigerating room. Typical operations and construction details pertinent to sanitation in each division are shown.

The second film illustrates the operational procedures in a typical



plant by a series of photographs of (a) poultry arriving from the farm, (b) ante-mortem inspection, and (c) step-by-step details of the cycle of processing poultry. Sanitary aspects are stressed in each operation: killing, defeathering, eviscerating, packaging, and storing or delivering to the consumer. The necessity for personal hygiene among the workers is emphasized.

Causes of Death Among College Students

—A Study of 209 Deaths at Yale University, 1920–55—

By HENRY M. PARRISH, M.D., M.P.H.

WHAT DISEASES and conditions kill our college students? How does mortality among them compare with that of the general population of the same ages? Are there specific diseases to which college students are more prone to succumb?

In answer to these questions, I submit the results of a study of deaths among the students at Yale University during the period 1920 through 1955. The causes of death among these students are set forth, and they are compared with the causes reported for other college groups and for the total population of the United States. It is hoped that these data will focus attention on some of the important student health problems and that they will emphasize the necessity for action on the part of colleges and universities in fulfilling their responsibility for student health needs.

Study Materials and Methods

The files of the department of university health, the department of mental hygiene and psychiatry, and the alumni records office of Yale

Dr. Parrish is assistant physician, department of university health, Yale University. He was a fellow in public health at the university's School of Medicine from September 1955 to June 1956, when he received the degree of master of public health. This paper reports a study he made in partial fulfillment of the requirements for that degree.

University were the primary sources of information. A student death was defined to include students who died during the academic year or summer vacation and those on medical or psychiatric leave of absence who died within 1 year after withdrawal. Calendar years, instead of academic years, were used to record the year of death.

To confirm the death and to determine the cause, the individual medical records at the department of university health were examined first. For students who died as a result of suicide and who had been seen in the department of mental hygiene and psychiatry, the records of that department were studied.

The hospital and autopsy reports of 23 students who died from medical and surgical diseases, or their complications, at the New Haven Hospital were also examined. Several errors in the original data were found and corrected on the basis of these records. Autopsy findings were used to correct clinical diagnoses whenever such findings were available.

Much valuable information was obtained from the individual records of the deceased in the alumni records office. For most of the students who died, these records contained the date of death or of withdrawal for medical or psychiatric leave of absence and a statement of the cause of death from the registrar of vital statistics in the town where death occurred. For most of those who died from accidents or suicides, they also contained newspaper clippings concerning the incident.

The name of any student who could not be

traced by one of the above methods was submitted to the registrar of vital statistics in the town where death occurred. The deaths of 21 students were confirmed in this manner.

Information concerning the cause of death was obtained from one or more of the above sources for 207 of 209 student deaths. For one student who died abroad, death was reported as accidental without specific details, and the cause of death for another student could not be determined.

The data collected on each student death included the name and class of the student, the date of death, the age at the time of death, the cause of death, and the place where death occurred. Additional information on accidental deaths and suicides was obtained from newspaper clippings describing the circumstances of the death.

Statistical Results

There were 209 deaths among the students at Yale University from 1920 through 1955, an average of slightly less than 6 each year. The only year in which no deaths occurred was 1920. The largest number of students died in 1949, when 16 deaths were recorded.

Of the 209 students, 86 percent were 15-24 years of age, 13 percent were 25-30 years, and 1 percent were over 30 years. Ninety-five percent were white males, and 5 percent were white females.

The five leading causes of death among the Yale students were accidents (43.8 percent), suicide (12.0 percent), heart and circulatory diseases (7.7 percent), pneumonia (7.2 percent), and infections of the central nervous system (6.3 percent). Of the accidental deaths, more than half were caused by motor vehicle accidents. The only other data available on deaths among college students are those reported by Diehl and Shepard from a study of deaths in 327 students at 9 universities during the period 1925-35 (1). In that study, the five leading causes were accidents (26.3 percent), heart and circulatory diseases (10.1 percent), suicide (8.0 percent), pneumonia (7.3 percent), and tuberculosis (6.4 percent). Again, motor vehicle accidents were the cause of more than half of the accidental deaths. The data on cause of death

Table 1. Causes of death among Yale students, 1920-55, and other college students, 1925-35

Cause of death	Yale students		Other college students: ¹ percent of deaths
	Number	Percent	
Accidents.....	91	43.8	26.3
Automobile.....	49	23.6	15.9
All others.....	42	20.2	10.4
Suicide.....	25	12.0	8.0
Heart and circulatory diseases.....	16	7.7	10.1
Pneumonia.....	15	7.2	7.3
Infections of the central nervous system.....	13	6.3	4.6
Malignant neoplasms.....	11	5.3	2.8
Septicemia.....	7	3.4	4.6
Leukemia.....	6	2.9	1.5
Tuberculosis.....	5	2.4	6.4
Nephritis.....	5	2.4	1.8
Appendicitis.....	4	2.0	4.0
Other causes.....	10	4.8	22.4
Cause unknown.....	1	0.5	0

¹ Reference 1.

obtained in these two studies are given in table 1.

Since 95 percent of the Yale students who died were white males and 86 percent of them were in the 15-24 age group, the deaths at Yale are compared with the deaths among white males aged 15-24 years in the total population of the United States. From the national death rates for this group, the number of deaths expected among Yale students each year of the study period was calculated. The results, presented in table 2, reveal that the number of deaths at Yale was lower than the number expected for every year except 1949. That year an airplane disaster in Seattle, Wash., took the lives of 11 students.

To compare the causes of death among Yale students with the causes for the total population, 1950 rates for white males aged 15-24 years as reported by Collins and his associates were used (2). Since there was only one death at Yale in 1950, these rates were applied to student deaths during the period 1946 through 1955. As shown in table 3, for only two causes was the number of deaths among Yale students above expectation. They were suicides, with 5.1 deaths expected and 7.0 deaths observed, and cerebral hemorrhage, with 1.2 deaths expected and 2.0 deaths observed. Neither of these val-

Table 2. Comparison of number of deaths expected if national death rates had prevailed with number of deaths observed among Yale University students, 1920-55

Year	National death rate per 1,000 population ¹	Number of students registered at Yale	Number of deaths expected	Number of deaths observed
1920	4.2	3,563	15.0	0
1921	3.4	3,875	13.2	7
1922	3.3	4,235	14.0	7
1923	3.4	4,490	15.3	7
1924	3.2	4,500	14.4	8
1925	3.2	4,796	15.3	9
1926	3.2	5,216	16.7	10
1927	3.0	5,438	16.3	6
1928	3.2	5,583	17.9	14
1929	3.2	5,663	18.1	5
1930	3.0	5,963	17.9	6
1931	2.9	6,049	17.5	1
1932	2.6	5,864	15.2	6
1933	2.5	5,723	14.3	7
1934	2.6	5,553	14.4	12
1935	2.6	5,418	14.0	10
1936	2.6	5,427	14.1	8
1937	2.5	5,488	13.7	4
1938	2.1	5,560	11.7	6
1939	2.0	5,692	11.4	7
1940	2.0	5,745	11.5	3
1941	2.1	5,719	12.0	2
1942	2.1	5,574	11.7	4
1943	2.5	5,267	13.2	2
1944	2.7	4,568	12.3	1
1945	2.6	3,709	9.6	1
1946	2.0	6,048	12.1	7
1947	1.8	8,862	16.0	5
1948	1.7	9,004	15.3	3
1949	1.6	8,768	14.0	16
1950	1.5	8,256	12.4	1
1951	1.6	7,716	12.2	3
1952	1.6	7,627	12.2	6
1953	1.6	7,558	12.1	4
1954	1.5	7,553	11.3	6
1955	² 1.6	7,555	12.1	4

¹ Rates for white males aged 15-24 years, published by the National Office of Vital Statistics in: Vital Statistics of the United States, 1950, vol. 1, p. 194; Annual Summary for 1954, part 2, Monthly Vital Statistics Report, vol. 3, No. 13, May 13, 1955; Annual Summary for 1955, part 2, Monthly Vital Statistics Report, vol. 4, No. 13, May 28, 1956.

² Estimated.

ues is statistically significant according to the chi-square test.

The vital statistics of the United States during the past half century reflect some striking changes in causes of death. Of the 10 leading

causes in 1900, 5 were communicable diseases. Pneumonia and influenza ranked first; tuberculosis, second; diarrhea and enteritis, third; diphtheria, ninth; and meningitis, tenth. In 1955, only one of these, pneumonia and influenza, was among the first 10 and none was among the first 5 (3).

To determine the trend in causes of death among Yale students, the numbers of deaths from accidents, infectious diseases (including pneumonia, meningitis, septicemia, tuberculosis, encephalitis, poliomyelitis, and others), and suicides were plotted for 10-year periods, as shown in the chart. Deaths due to infectious diseases have declined steadily. Accidents have remained at a high level and have been the most prominent cause of death in students since the decade 1930-39. The number of suicides rose sharply during the decade 1930-39, the depression years, then declined during the next decade, the war and postwar years.

Discussion

The finding that mortality among the students at Yale University is generally much

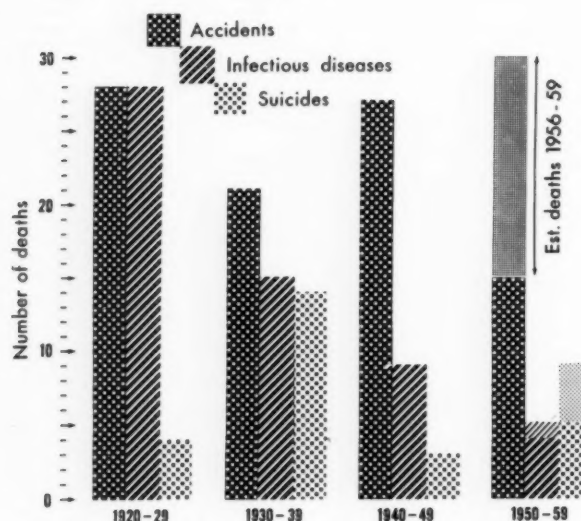
Table 3. Comparison of number of deaths expected if national death rates had prevailed with number of deaths observed among Yale University students, by cause of death, 1946-55

Cause of death	National death rates per 100,000 population ¹	Number of deaths expected ²	Number of deaths observed
Accidents	91.9	72.6	38
Malignant neoplasms other than leukemia	7.7	6.1	4
Diseases of the heart	5.8	4.6	1
Tuberculosis (all forms)	4.3	3.4	0
Suicide	6.6	5.2	7
Pneumonia	2.6	2.1	1
Acute poliomyelitis	2.3	1.8	1
Cerebral hemorrhage	1.6	1.3	2

¹ 1950 rates for white males aged 15-24 years, as reported by Collins, Lehmann, and Trantham (ref. 2).

² Based on total student population of 78,947 for the 10-year period, as determined by adding annual registration figures.

Number of deaths from accidents, infectious diseases, and suicide among Yale University students for 10-year periods, 1920-59



lower than that of the general population of the same ages is not unexpected, for several reasons: College students, for the most part, are adolescents and young adults in good health. The majority of the students at Yale are from an average or an above average socioeconomic group. Most of them eat in the college dining halls, where well-balanced meals are served. Yale students are a selected intellectual group, who are probably better informed about health matters than the general population of the same ages. College entrance physical examinations help detect disease and single out for special care students with medical problems. Complete medical care is available to all students 24 hours a day, 7 days a week, while school is in session.

This study clearly points to accidents as the number one health problem among college students, just as they are in the general population in the age group 15-24 (4). At Yale, accidents accounted for more deaths than the next five most common causes combined. Accidental deaths have continued at a high peak, while deaths due to infectious diseases have been on the decline. There are no reliable statistics regarding the incidence of accidents at Yale, but preliminary data suggest that 1 Yale student in 4 has an accident requiring medical treatment each year.

In the general population, motor vehicle accidents cause more deaths than any other type of accident among persons under 65 years of age (4). This proved true at Yale, where 23.6 percent of all deaths were caused by motor vehicle accidents. Most of the motor vehicle deaths occurred outside Connecticut, and most of the ones in Connecticut happened outside New Haven. Closely related to these findings is the fact that most of the fatal motor vehicle accidents took place over the weekend. Since Yale is primarily a men's college and since there are no girls' schools in the immediate vicinity, many of the undergraduate students travel long distances in automobiles over the weekend to see young ladies. Other students drive home to spend the weekend with their families.

Suicide was the second most common cause of death among Yale students. The number of suicides was highest during the depression years and lowest during and immediately following World War II, a pattern which is consistent with the pattern of suicidal deaths for the general population. There is no clear explanation for this phenomenon, but some authorities feel it is because the potentially suicidal individual diverts his thoughts, and his pent-up anger, from himself to the war effort and the potential enemy.

Most of the causes of death among college students are amenable to prevention and treatment programs. Communicable diseases are today readily controlled with antibiotics. Through health education, it should be possible to prevent many accidents. With the provision of adequate psychiatric counseling, it may be possible to reduce the number of suicides. Promotion of mental health is an important function of any college health department, since it has been estimated that about 10 percent of the students need professional help with their emotional problems (5).

The college situation affords unusual opportunities for a productive campaign against accidents. College students are in a learning situation; they are maturing individuals; and they are congregated together where they can be reached. As a result of this study of deaths at Yale, plans are now being made for an investigation of accident morbidity at the university. This investigation should provide

information around which a preventive educational campaign can be constructed.

American colleges and universities have an obligation, a duty, to protect and promote the health of their students. Are our institutions of higher learning fulfilling this obligation? It is estimated from a 1953 survey of 1,157 colleges that of every 3, 1 has no clinical service, 1 has clinical services for minor disorders, and 1 has clinical facilities for both major and minor disorders (6). Thus, it appears that there is a definite need to stimulate the interest of administrators, teachers, trustees, and parents in health and medical facilities for college students.

Summary

1. In a study of the 209 student deaths at Yale University from 1920 through 1955 the following were found to be the most common causes of death: accidents (43.8 percent); suicide (12.0 percent); heart and circulatory diseases (7.7 percent); pneumonia (7.2 percent), and central nervous system infections (6.3 percent).

2. Deaths from infectious diseases have decreased, but accidental deaths have remained high. Accidents have been the number one

killer of college students since the decade 1930-39.

3. The number of deaths among the Yale students was lower than would be expected if national death rates had prevailed. There were more suicides among the students than would be expected, but the difference was not statistically significant.

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Porterfield Named Assistant to the Surgeon General

Dr. John D. Porterfield, a career officer of the Public Health Service since 1939, assumed his duties as assistant to the Surgeon General on October 16, 1956.

He comes to his new position from Ohio where he was director of the Ohio State Department of Health from 1947 to 1954 and director of the Ohio Department of Mental Hygiene and Correction since 1954.

In his new assignment, Dr. Porterfield will give particular attention to the fields of chronic disease and aging.

He is chairman of the editorial board of the American Journal of Public Health; chair-

man of the mental health section of the American Public Health Association; former secretary and later chairman of the association's health officers section; former secretary and later vice president of the Association of State and Territorial Health Officers, and a member of the Scientific Study and Planning Committee of the Joint Commission on Mental Illness and Health. He also is associate professor of preventive medicine at the Ohio State University Medical School at Columbus and a visiting lecturer at the University of Michigan School of Public Health at Ann Arbor.

Cherokee Indian Health Survey

By CHARLES M. CAMERON, Jr., M.D., M.P.H.

oU l S J

These characters in the Cherokee alphabet mean "Are you well?" They are used as a greeting.

TO ASSESS health conditions among the Cherokee Indians in North Carolina, a multiphasic survey was conducted at the reservation in April 1955. It was a joint venture of the Bureau of Indian Affairs, the Public Health Service, the North Carolina State Board of Health, the Jackson-Macon-Swain District Health Department of North Carolina, and the University of North Carolina School of Public Health.

Participation in the survey was limited to reservation inhabitants 15 years old or over. During a 2-day examination period, about 1,000

of the 2,500 to 3,500 residents received the various tests. The entire group received chest X-rays and serologic tests for syphilis, as well as height and weight determinations. Those 15 to 25 years were examined for blood vitamin levels. Those 25 years or over were asked for information about their diets and received diabetes screening tests.

In addition to a team of workers from the Federal, State, and local health agencies, more than 50 volunteer workers from the reservation and surrounding communities participated in the survey. Success of the operation is credited to the excellent presurvey educational and informational program conducted by personnel of the district health department and the Cherokee Indian Agency.

Results from the survey confirm that the Cherokees in North Carolina enjoy a state of health superior to that of many other Indian groups in the United States. The health of this group compares favorably with that of other residents of the mountainous area along the Tennessee-North Carolina boundary.

Dr. Cameron, associate professor of public health administration, University of North Carolina School of Public Health, was director of the team of Federal, State, local, and volunteer health workers who planned and conducted the screening project at the Cherokee Indian Reservation. His avocational interest in photography has made possible this picture story of the project.



The survey site was the arts and crafts building located on the reservation at Cherokee Indian Village. Facilities for determining heights and weights, taking nutritional histories, and taking and processing blood samples were set up inside. Mobile X-ray units from the North Carolina State Board of Health were parked behind the building.

Indian Agency school buses carried many participants to and from the survey site. Entire families came and the scene rapidly assumed a festive air.

The weight and height of each participant was determined by volunteer workers. Results are being compared with a study of weights and heights of the Cherokees made some 30 years ago.

Nutritionists from the North Carolina State Board of Health recorded diet histories for all participants being screened for diabetes.

The participants queued up preparatory to entering 1 of 3 curtained-off areas where blood samples were drawn for diabetes screening, serologic tests for syphilis, and determination of serum vitamin levels.





A Public Health Service officer assigned to the North Carolina State Board of Health took blood samples. Of 973 serologic tests for syphilis, only 5 were positive. Four of these cases were found to have had adequate treatment.



The Hewson Clinitron, loaned by the Public Health Service, was used in screening blood samples for elevated blood sugar. Of 761 persons over 25 years of age, 24 diabetes suspects were singled out. Followup on these is in progress.



Final step was a chest X-ray. More than 90 percent of the 1,020 persons examined were essentially negative. Of 31 persons selected for rescreening, 16 were found to have tuberculous infection, but all were in an inactive stage.



Blood specimens were frozen and then shipped to the University of North Carolina, where serum vitamin A and C determinations were done. Preliminary reports indicate that the group surveyed tends to have a lower plasma ascorbic acid level than certain well-nourished population groups in the northeastern States. The serum vitamin A levels compare favorably with results obtained in other regional surveys.

Although not participants in the survey, Cherokee youngsters exhibited great interest in the activities. The two pictured are watching their parents as they progress through the survey line. →



Serologic Survey for Syphilis In Migratory Labor Camps Of Upstate New York

By EVAN W. THOMAS, M.D.,
and JOSEPH GIORDANO, M.S.

CASE FINDING of syphilis among migratory laborers has been a difficult problem. In New York State the same facilities for venereal disease control are available to migrants as to all residents of the State. However, many migrants do not know about these facilities. Even when they do, many are reluctant to use them unless incapacitated by pain or illness. Clinics, whether operated during the day or night, have not been a satisfactory means of discovering more than a portion of the syphilis believed to be present. Therefore, the policy adopted by the Public Health Service of providing funds for serologic surveys for syphilis to be conducted in the labor camps was welcomed in New York State.

New York is a large State, and migrant workers during the summer and fall months are scattered throughout, from Long Island to the most western counties. Since many of the camps accommodate less than 20 migrants, serologic surveys reaching all migrants in the State are obviously impractical. However, with proper planning, large numbers can be tested by conducting surveys in the larger camps. To accomplish this, the location and

census of labor camps must be known, and operations should be confined to areas where the least possible time is needed for travel from camp to camp. Sanitation officers of the three New York State districts in which the surveys were conducted were very helpful in providing this information and in planning contacts with the camp owners and managers prior to the actual surveys.

The efficiency of the campaign was greatly augmented by the full cooperation of the personnel in these offices. In the last analysis, however, the success of the survey depended on the personnel of the teams in the field. The young men and women composing these teams worked many more hours than the usual 40 in a week. They refused to be stopped by difficulties that could be overcome by additional planning and hard work. They worked well with each other and wasted little time. Had it been otherwise, the number of patients examined would have been much smaller.

The Operating Teams

Starting July 11, 1955, and finishing September 23, 1955, two teams, consisting of a clerk and a nurse, or technician, skilled in doing venipunctures, operated in camps located in eight counties of northwestern New York State. Blood was withdrawn from the workers after they returned from the fields in the evenings or while they were in camp on rainy days. With rare exceptions, the cooperation of all workers, 15 years of age or over, was easily obtained, and operations within the camps usually continued until 10:30 or 11 p. m. Owing to advance notice, the workers were prepared for the visit at night, and little time was lost in getting under way after the team arrived. Frequently, each team visited several camps in a single night. During each working day, one of the members of the two operating teams visited the camps to be surveyed that night, thus assuring a good reception and a well-organized plan of operations for the night.

As the nearest serologic laboratory equipped to handle the increased volume of blood speci-

Dr. Thomas is a consultant in venereal disease control, New York State Department of Health. From 1936 to 1955 he was director of the syphilis service in Bellevue Hospital, New York City. Among his publications on venereal disease is the book, "Syphilis: Its Course and Management," 1949. Mr. Giordano is a health program representative in the venereal disease control field, assigned by the Public Health Service to the New York State Department of Health.

Table 1. Results of testing for syphilis among migrant workers in New York State, July 11–September 15, 1955

Age group (in years)	White				Nonwhite			
	Number tested	Number positive	Number doubtful	Percent reactive	Number tested	Number positive	Number doubtful	Percent reactive
<15	8	0	0	0	118	3	1	3.39
15–24	54	1	1	3.70	1,726	92	40	7.65
25–34	36	0	0	0	1,217	216	83	24.57
35–44	36	0	0	0	1,008	238	91	32.64
45–54	14	0	0	0	631	173	71	38.67
55–64	6	0	0	0	258	82	30	43.41
65+	1	0	0	0	63	8	6	22.22
Total	155	1	1	1.29	5,021	812	322	22.59

mens was usually 20 to 60 miles from the headquarters where the teams were working, one of the team members motored to the laboratory each morning to deposit the specimens drawn the night before and to pick up reports on those that had been tested. In this way, workers found to have positive reports could be interviewed and treated, if necessary, within several days at the most after the blood had been withdrawn. Treatment was given by a physician or under the direct supervision of a physician. Although treatment was arranged at the shortest possible interval after blood was taken, it was impossible to find all migrants whose serologic tests were reported positive or doubtful. In some cases, blood specimens were taken from workers who were only visiting the camp on the night blood was withdrawn. In other cases, workers had transferred to another camp or were absent the night treatment was given. Repeated visits to a camp to find one or more seropositive cases were usually impractical. About 10 percent of the nonwhite persons with positive or doubtfully positive test reports could not be interviewed or examined for treatment.

Treatment

In mass surveys of this kind, the advantages of examining and treating the largest possible number of persons must be weighed against the desire to maintain high standards of diagnosis. In the absence of clinics and the full cooperation of patients, thorough diagnostic examinations are impossible. In the migrant survey,

quality of diagnosis was frankly sacrificed for quantity. As a result, probable diagnoses were based largely on the report of a single serologic test for syphilis performed by a flocculation technique usually used only for screening purposes. Attempts were made to obtain histories from all patients with positive or doubtful test reports. The histories were frequently vague and unreliable. Therefore, we treated, on suspicion, most patients with doubtful tests for syphilis and no reliable history of previous adequate treatment.

Treated patients were given a card with the date and the kind and amount of therapy received. They were told to keep the card with their Social Security card or driver's license and to show it at future medical examinations. Even though some or many of these cards may be lost, unnecessary re-treatment might be avoided in numerous cases, if the practice of providing migrants with such a record of treatment were to become universal.

Treatment consisted of a single injection of 2,400,000 units of benzathine penicillin G, contained in a disposable syringe. This dose, concentrated in a total volume of 4 milliliters, caused varying amounts of pain and soreness at the site of injection. A few patients coming to our attention were incapacitated by pain for periods of at least several days. The single injection is convenient and it saves time, but complaints of severe pain would undoubtedly have been diminished or avoided had 1,200,000 units of a less concentrated suspension been injected into each buttock. The only other incapaci-

tating reaction coming to our attention was in a woman who was hospitalized for "serum sickness."

Test Results

Serologic test results were received for 5,176 persons of which all but 155 were nonwhite (table 1). The white persons tested, although temporarily living in labor camps, were not migrants from outside New York State. Among these 155, there was 1 reactor in 127 men and 1 doubtfully positive result in the 28 women, making an overall reactive rate of 1.29 percent. Both were in the age bracket 15-24. The man had received no previous treatment, and the woman was given additional therapy.

The overall reactive rate for the 5,021 non-

white persons was 22.59 percent. The rate of positive and doubtful reactivity for nonwhite women ranged from 4.92 percent in the small number of 61 girls under 15 years old to 41.12 percent in women aged 45-54 and was consistently higher than for men of all ages up to this point (table 2). For persons over 55, the rate for women was 28.6 percent compared with 41.9 percent for men. For all nonwhites, the range was from 3.39 percent in children under 15 years old to 43.41 percent for persons aged 55-64.

A slightly higher (although generally consistent) percentage of doubtful reports occurred among women than men. Experiences with the specific treponemal immobilizing antibody tests show that more biological false-positive serologic tests for syphilis are found in women

Table 2. Results of testing for syphilis among nonwhite migrant workers in New York State, July 11-September 15, 1955

Age (in years)	Male				Female			
	Number tested	Number positive	Number doubtful	Percent reactive	Number tested	Number positive	Number doubtful	Percent reactive
<15	57	1	0	1.75	61	2	1	4.92
15-24	1,131	46	20	5.84	595	46	20	11.09
25-34	747	113	45	21.15	470	103	38	30.00
35-44	679	146	54	29.46	329	92	37	39.21
45-54	434	118	45	37.56	197	55	26	41.12
55-64	206	67	27	45.63	52	15	3	34.62
65+	52	8	6	26.92	11	0	0	-----
Total	3,306	499	197	21.05	1,715	313	125	25.54

Table 3. Disposition of reactors in nonwhite migrant workers in New York State, July 11-September 15, 1954

Age (in years)	Number reactors	Number reactors examined	Brought to treatment		Returned to treatment		Adequate previous treatment		Number reactors not examined
			Number	Percent examined	Number	Percent examined	Number	Percent examined	
<15	4	3	2	66.67	1	33.33	-----	-----	1
15-24	132	112	79	70.54	17	15.18	16	14.29	20
25-34	299	254	148	58.27	33	12.99	73	28.74	45
35-44	329	295	169	57.29	60	20.34	66	22.37	34
45-54	244	221	128	57.92	51	23.08	42	19.00	23
55-64	112	107	56	52.34	14	13.08	37	34.58	5
65+	14	12	8	66.67	2	16.67	2	16.67	2
Total	1,134	1,004	590	58.76	178	17.73	236	23.51	130

than in men, and an undetermined number of the doubtfully positive tests in this survey may not have represented a past or present syphilitic infection. As previously mentioned, when in doubt we usually treated without attempting further examination.

The difference between the percentages of reactive reports in the white workers who were not actually migrants and the nonwhite migrants is striking, but it must be recognized that the mode of life and socioeconomic status of migrants are peculiarly conducive to venereal disease. The laborers follow the crops in many sections of the country. They comprise a moving army without benefit of the discipline and living conditions provided to most armies. Many have had little or no formal schooling. Yet, migrant laborers are still an indispensable part of our agricultural economy, and their health is of national concern.

That some progress has been made in the general reduction of the reservoir of infectious syphilis among migrants may be inferred from table 3. While the older ages have the higher rates of reactivity, it is also true that a greater proportion of those reactors had either already been adequately treated for their infection or at least had once been under the care of a physician and had received some treatment. These data may show some past accomplishments, but the great majority (over 70 percent) of the re-

actors in the younger age groups had no treatment for syphilis. If syphilis is to be controlled, case finding in the younger age groups is essential. Bringing these younger migrants with reactive test results to treatment was in itself justification of the survey.

Treatment for Gonorrhea

Due to the lack of privacy and also of time, male patients were not examined for urethral discharges in many of the camps. However, all migrants with such complaints or other illness were urged to report them. As a result, 95 males were treated with penicillin because of urethral discharges, and 24 female contacts of these patients were also treated.

Summary

Reports of serologic tests for syphilis were received for 5,021 nonwhite migrants. Of these, 812 (16.2 percent) had definitely positive tests, and 322 (6.4 percent) had doubtfully positive tests. Histories of adequate previous treatment were obtained from 236 of the patients with positive or doubtfully positive tests. Of 155 whites examined, only one had a definitely positive test report, and one had a doubtful report. A total of 770 patients received penicillin therapy for presumed syphilis and 119 were treated for presumed gonorrhea.

Tranquilizing Drug Research

The Public Health Service has established the Psychopharmacology Service Center in the National Institute of Mental Health, Bethesda, Md. The center will assist in the development of scientifically sound nationwide research on tranquilizing and other phrenotropic drugs used in the treatment of mental illness. Technical and research advisory services will be provided to scientists.

Dr. Jonathan O. Cole has been appointed psychiatrist in charge of the center. He received his psychiatric training at the Payne Whitney Clinic of the New York Hospital, New York City. Following 2 years' service as an Army psychiatrist, Dr. Cole joined the staff of the Division of Medical Sciences, National Research Council, Washington, D. C., where he worked with its committees on psychiatry and stress.

The Use of the Membrane Filter Technique for Testing Water Supplies in the Field

By MALCOLM C. HOPE, Ch.E., M.P.H., and ARTHUR H. NEILL, C.E., M.P.H.

TWO STUDIES conducted in western national parks during the early summer of 1955 evaluated the feasibility of using the membrane filter field test laboratory to determine the bacteriological quality of the drinking water supplies in the national parks.

The many widely dispersed water supplies in the parks vary from small springs, infiltration systems, wells, or surface supplies to community-type systems. Although the conventional sanitary survey of any water supply system provides data on potential sources of contamination and general adequacy of treatment and distribution, routine examinations for bacteriological safety are needed. The results of such examinations also serve to guide the operation and provide a record which reflects the sanitary quality over an extended period.

Because of the relatively isolated location of many parks and their water supplies, it is often time consuming to collect and mail samples and await reports from State laboratories which may be several hundred miles away. Frequently, in the time between sample collection and examination, a change occurs in the character of the sample, and results may not always reflect the condition of the supply.

Mr. Hope is chief, General Engineering Program, Division of Sanitary Engineering Services, Public Health Service. Mr. Neill is a sanitary engineer in the Technical Services Section of the program.

Considering the relatively short season in many park areas, a method of performing a simple, rapid, field test to supplement regular laboratory examinations would be valuable.

The membrane filter technique was introduced into the United States from Europe in 1947. Considerable research has been conducted in the United States, including laboratory studies by the Robert A. Taft Sanitary Engineering Center of the Public Health Service, to develop the technique for the bacteriological examination of drinking water. The membrane filter procedure has been accepted as a tentative method in the 10th edition of Standard Methods for the Examination of Water, Sewage, and Industrial Wastes. Portable field test laboratories (MF kits) are available to run tests and obtain results in the field. The time required to obtain results with MF kits is approximately 18 to 20 hours as compared to 2 or 4 days, plus time in transit, with the standard dilution tube test.

Initiation of Studies

Although evidence (1) indicated that the MF field kit might be used effectively with national park water supplies, it was considered desirable to run a trial under actual field conditions. The National Park Service requested that the Public Health Service perform special studies relating to the applicability of the membrane filter technique. A project proposal of the work and objectives was outlined. Two duplicate studies of

approximately 6 weeks' duration were initiated in June 1955 in national parks. One study was conducted by John D. Eye, professor of sanitary engineering, Virginia Polytechnic Institute, in the Rocky Mountain National Park, Colo. The other study was conducted in the Yosemite and Sequoia-Kings National Parks, Calif., by Ely J. Weathersbee, instructor, Oregon State College. Both investigators, who are sanitary engineers, were called to temporary active duty from the Commissioned Reserve Corps of the Public Health Service.

In addition to studying the applicability of the membrane filter field test laboratory, they conducted sanitary surveys of water supplies sampled for examination by the MF kit. These surveys included inspections of the collection, treatment, and distribution systems of each water supply and a brief study of the drainage areas. In separate reports, the investigators have correlated the results of the bacteriological tests with the sanitary surveys.

Materials and Methods

The MF kit contains the necessary equipment for filtering and incubating the samples and sterilizing the funnel assembly in a rugged, portable carrying case which weighs 30 pounds fully loaded. Membrane filters and dehydrated nutrient media pads were used in the studies. Packs, each containing sufficient membranes and media for six tests, were purchased pre-sterilized in sealed polyethylene bags.

Additional items of equipment were found to be necessary for the tests. These included bottles for collecting water samples and storing sterilized dilution water, hand magnifying lens to assist in counting coliform colonies, improved plastic tape for sealing petri dishes prior to immersing in the thermos bottle incubators, and 95 percent ethyl alcohol for dipping the forceps tips prior to flaming.

The collection of samples and the examinations were conducted in accordance with the procedures outlined in the 10th edition of *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes*. Parallel standard dilution tube tests were run on approximately one-third of all samples collected and results obtained by the two methods were

compared. The comparison was made to determine the degree of correlation of the MF kit field results with the standard dilution test results.

Briefly, the MF technique is to filter, under suction, a water sample portion through a small (2-inch diameter) circular, paper-thin disc composed of a cellulose material with pore openings of submicron size (1). Any bacteria present in the sample collect on the surface of the filter. The disc is transferred to a petri dish containing an absorbent pad with a small amount of nutrient broth culture media. A small quantity of sterile water is added to the petri dish which is then sealed and incubated in thermos bottles, provided in the MF kit, at approximate body temperature 37° C. After 18 or 20 hours, the dishes are removed from incubation, and those colonies exhibiting a metallic sheen, characteristic of coliform organisms, are counted. Results are recorded as the number of coliform organisms per 100 ml. of sample. Absence of coliforms indicates freedom from contamination.

Usually, in the Rocky Mountain National Park study, the MF kit was taken to the water sampling site where the test was performed. During inclement weather, the field laboratory was established in a ranger dormitory kitchen made available by the park superintendent. A home-type pressure cooker and a small electrically operated incubator were utilized for the standard dilution tube test and also for sample bottle sterilization. In Yosemite, the field laboratory was set up in the sewage treatment plant laboratory where a home-type pressure cooker was available for necessary sterilization of sample bottles, preparation of dilution tubes, and production of sterile water for use in rehydrating nutrient absorbent pads. Both investigators were assisted by park officials in locating water supplies and in obtaining the use of park equipment and facilities.

The MF kits, reputedly among the best available at the time of the studies, were ordered shortly before the initiation of the field work. Despite mechanical difficulties experienced with the MF kits early in the studies, the equipment performed in a satisfactory manner after adjustments. Most of the difficulties were related to ill-fitting petri dish holders, leakage of fun-

nel apparatus, and wetting of membrane cultures in petri dishes in the thermos bottles because of leakage of parafilm tape supplied with the kit.

One major difficulty, which persisted throughout the course of the studies, concerned the method of incubation of the membrane filter cultures. Thermos bottles supplied with the kits are used for incubation. Under low temperature conditions prevailing during the studies, a significant drop in temperature, as much as 20° F. 4 hours after starting the incubation of cultures, occurred in these thermos bottles.

Although the exact effects of such variation from required incubation temperatures were not evaluated, evidence indicated that the results were adversely affected. More recent improvements in MF kits also provide built-in electrically heated incubators that are adaptable to battery or to standard power sources.

As many of the individual tests were performed where the samples were obtained, open air conditions interfered with the use of the kit. Turbidities were abnormally high in the surface supplies during the early period of the studies because of the spring runoff. Because of the turbidity, difficulty in filtering enough water to obtain significant growth was reported from both study sites. Also, on some samples sediment deposited on the membrane so spread bacterial growth that coliform organisms could not be identified or counted.

The use of dehydrated nutrient media pads was considered convenient and satisfactory. However, possible inhibition of coliform growth related to the use of this nutrient method was suspected in the Rocky Mountain Park study.

Results of Parallel Tests

The determination of the agreement of the MF test with the standard dilution tube test was included in the studies. Temporary laboratory facilities and equipment to run the standard methods test were assembled in the parks. In addition, some samples were sent to State health department laboratories for examination.

Standard dilution tube tests were run on

Comparison of results of parallel membrane filter and standard dilution tube tests applying the 95 percent confidence limit to the MPN obtained by the standard dilution tube test

Park study area	Number of samples	Number of samples agreeing	Number of samples disagreeing	Percent agreement
Rocky Mountain.....	69	56	13	81
Yosemite and Sequoia.....	54	50	4	93
Both studies.....	123	106	17	86

approximately one-third of all samples collected for examination by the membrane filter technique. With the standard dilution tube method, an estimate of the most probable number (MPN) of coliform organisms is calculated, and test results are reported in coliforms per 100 ml. of sample. In the MF test, a direct count of coliforms on the membrane filter are made, and results are also reported per 100 ml. of sample.

In comparing the results of the two tests on the same sample of water, the 95 percent confidence limit was applied to the standard dilution tube test results in recognition of the bias in the standard method.

In the present studies, the coliform counts obtained by the MF test were generally lower than those obtained by the standard dilution tube test. In some cases, the lower counts were caused by excessive turbidity that limited the amount of sample that could be filtered as mentioned previously.

The results of only 17 of the 123 total parallel tests were in disagreement by the two methods (table). The number of results in disagreement was higher in the Rocky Mountain National Park study than at Yosemite and Sequoia-Kings National Parks. Considering the difficulties encountered, the agreement of the two methods is deemed satisfactory and indicates that the membrane filter test results are reliable.

Conclusions

1. The 86 percent agreement in the results obtained by the membrane filter technique and

the standard dilution tube test on the same samples is considered satisfactory. Elimination of mechanical difficulties experienced would undoubtedly further increase the agreement.

2. Results of the membrane filter tests were known in less than 1 day and were directly applicable to the evaluation of individual water supplies which had been surveyed during the course of the studies. When the samples were mailed to central laboratories, results of the standard dilution tube method could not be obtained in less than 7 to 10 days.

3. The samples collected from the surface water supplies during the early spring runoff generally contained high turbidities which were difficult to analyze by the membrane filter method.

4. Satisfactory results were obtained when the portable testing kit was set up in a central shelter within the parks where samples were

brought for analysis. Exposure to open air conditions affects the operation of the kit if the analysis is made at the sampling site.

5. The operation of the kit is simple and rapid; however, specialized training and familiarity with the equipment is necessary for obtaining results which can be properly evaluated.

6. The membrane filter method can be used for bacteriological examination of isolated water supplies as found in national parks. However, the studies clearly indicated the need for improvements in the portable field laboratories (MF kits), particularly in the method of incubation.

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Public Health Training Program

Under a new Public Health Service training program, 266 public health workers are now enrolled in graduate training in more than 40 schools. Authorized by Congress on July 23, 1956, the program went into effect in the fall semester with awards of almost \$1 million in training grants to schools and individuals.

Upon completion of their studies, most of the trainees will be employed in State and local health departments, thus helping to relieve the acute personnel shortage that has prevented many areas from making full use of modern knowledge about the prevention and control of disease.

Under the awards, 130 nurses are being trained for public health nursing positions through grants totaling \$377,618 to 32 schools of nursing. Grants totaling \$260,137 to 10 schools of public health are training 47 students who are specializing in various other types of public health activities.

In addition, training grants were awarded directly to 89 persons: 7 physicians, 6 dentists, 5 dental hygienists, 39 sanitary engineers and other sanitation specialists, 3 veterinarians, 5 nutritionists, 18 health educators, and 6 persons from other professions concerned with public health.

In this paper, the third the authors have prepared on N-dodecyl-1,3-propanediamine, the chemical's value as a practical disinfectant against Mycobacterium tuberculosis is described, with tentative comments on toxicity and sensitization.

Tuberculosis Disinfection With Diamine

By ANSON HOYT, M.D., ARTHUR H. K. DJANG, M.D.,
and C. RICHARD SMITH, M.D.

THE CHEMICAL N-dodecyl-1,3-propanediamine (hereafter called "diamine") has shown high growth inhibiting properties for tubercle bacillus suspensions (1). Additional experiments were performed to test the use of diamine as a practical disinfectant against tuberculous sputum, and to inquire into its toxicity, skin irritating and sensitizing properties.

Methods

The solubility of diamine is high in ethyl or isopropyl alcohol but low in water. Triton

X-100 (Rohm and Haas, polyethylene glycol alkylaryl ether) permitted concentrated diamine solutions in alcohol to remain clear on further dilution with distilled water, even when sodium hydroxide was present. Solution or suspension methods (diamine, Triton X-100 and sodium hydroxide by weight, isopropyl alcohol by volume) are given for each experiment.

Inclusion of small proportions of sodium hydroxide enhanced the antibacterial potency of diamine, as is clearly shown in this report. Diamine is alkaline but has a low buffer capacity, and sodium hydroxide probably aids its action by maintaining a more nearly optimal alkaline pH.

The concentrations of isopropyl alcohol and Triton X-100 that contacted tubercle bacilli and sputum contaminants were generally rather low, and alcohol was only used once in a final concentration above 10 percent. Concentrations of isopropyl alcohol alone as high as 10 percent and Triton X-100 alone as high as 2 percent, or both together in these respective strengths, showed no inhibition against tubercle bacilli or sputum contaminants in a whole sputum test.

Dried Sputum Film Test

Purulent sputum pools containing large numbers of tubercle bacilli were shaken with beads 3 hours at 37° C. to make fairly fluid and homogeneous mixtures (2). Films from 0.05 ml.

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of such sputum, spread over 2 x 3 cm. rectangles on cover slips, were dried in the dark, generally at room temperature. Stained films from different pools showed from approximately 5 to more than 100 single acid-fast rods or small clumps per oil immersion field.

For the test, usually run in duplicate, a film was dropped into 40 ml. of diamine, held for the desired time at 20° C., quickly rinsed in 40 ml. of water to remove excess disinfectant or in a like volume of sodium ricinoleate to further neutralize some disinfectant (3), and then dropped into 40 ml. of water or weak sodium hydroxide containing glass beads. Hard shaking broke the cover slip and dispersed the film. This film-containing liquid was cultured on 3 slants, generally Loewenstein-Jensen medium, in 0.1 ml. volumes. Control films contacted water instead of diamine and were finally shaken in weak sodium hydroxide, before culturing, to inhibit the growth of contaminants. A maximum 0.25 percent of a film or 0.000125 ml. of original sputum was inoculated on each slant, which generally produced over 50 colonies in every control culture. Unfortunately diamine often dissolved rather large fractions of the films, so that culture inoculums tended to be below the stated maximum.

Guinea pigs were sometimes inoculated subcutaneously in parallel with cultures using volumes as large as 5 ml. or a maximum 12.5 percent of a film.

Whole Sputum Test

A measured volume of diamine (double the desired final concentration) was added to an equal volume of sputum, thoroughly shaken and held at 20° C. or room temperature for 30 minutes with intermittent agitation. It was then quickly diluted 100 times in water or weak sodium hydroxide and inoculated in 0.1 ml. volumes on culture slants. Guinea pigs were sometimes also given much larger subcutaneous inoculums. The final diluent sometimes contained small amounts of potassium ricinoleate which somewhat checked the action of diamine but had no demonstrable effect on the growth of tubercle bacilli. Control sputum plus water was finally diluted in 1 percent sodium hydroxide to control contaminants.

The advantages of this test were:

1. A known amount of sputum went completely through the test.
2. It was easy to run.
3. Four times as much original sputum (0.0005 ml.) was planted on each slant as the maximum culture inoculum (0.000125 ml.) in the dried sputum film test.

The disadvantage of the whole sputum test, apparently not a major one with diamine (3), was that 1 percent of the test dilution of disinfectant went through to the final culture.

Diamine on Concrete or Glass Surfaces

Two techniques were employed on concrete or glass surfaces. In one, 3 x 4 cm. rectangles on concrete or glass were contaminated with sputum which was allowed to dry. They were later covered with varying diamine dilutions. In the other, diamine was applied and allowed to dry and sputum was later placed over the same areas and allowed to dry. Care was always taken to keep the sputum boundaries within the diamine areas. These techniques were performed at room temperature. Sputum only was placed on control areas.

For the test a sterile swab was dipped into water or weak sodium hydroxide, rubbed over a rectangle and rinsed in the original fluid. This was repeated several times and cultures were then inoculated from the rinse fluid. Guinea pigs were also injected in one experiment. Control areas were swabbed with and rinsed in weak sodium hydroxide.

Results

A number of experiments with the dried sputum film technique pointed in the same direction. Two such tests are summarized. In the first test a 1 percent diamine stock solution in 50 percent isopropyl alcohol without sodium hydroxide was diluted in distilled water to 1:2,500 and 1:5,000 diamine concentrations. Films contacted these dilutions for 30 minutes. When films were shaken in 0.5 percent sodium hydroxide as the final diluent before culturing, 1:2,500 diamine caused complete growth inhibition and 1:5,000 produced marked but incomplete inhibition. When water was used as the final diluent, however, the 1:2,500 diamine con-

centration caused only partial inhibition of growth. The approximate mean colony count per tube in the control cultures was 300.

In the second test a stock solution containing 1 percent diamine, 1 percent sodium hydroxide, and 4 percent Triton X-100 in 60 percent isopropyl alcohol was diluted in distilled water to 1:1,000 and 1:5,000 diamine concentrations. Films were immersed for 10 minutes and were finally shaken in water before culturing. Growth inhibition was complete at the 1:1,000 dilution and two guinea pigs were negative for tuberculosis. At the 1:5,000 dilution growth inhibition was marked but incomplete and both guinea pigs were positive for tuberculosis. The approximate mean colony count per tube in the control cultures was 100.

These experiments illustrate the range in which diamine has caused complete inhibition by the dried sputum film technique, when weak sodium hydroxide was present either in the original diamine formulation or in the final diluting fluid. In the first experiment diamine proved definitely less effective when tested in the absence of sodium hydroxide.

Two representative experiments illustrating the whole sputum test technique are summarized. A tuberculous sputum pool, which yielded over 1,000 colonies per control slant, was used. Exposure to diamine was 30 minutes at 20° C.

In the first test diamine was diluted in water or in 0.1 percent sodium hydroxide from a 1 percent diamine, 10 percent isopropyl alcohol stock solution, and mixed with equal volumes of undiluted sputum. The final diluent before inoculating cultures and guinea pigs was water without sodium hydroxide but containing 1:6,000 potassium ricinoleate. Control sputum plus water contacted 1 percent sodium hydroxide in the final diluent to control contaminants before culturing.

A 1:625 final dilution of diamine without sodium hydroxide caused a moderate but not complete inhibition of *Mycobacterium tuberculosis*, and two guinea pigs were positive. However, it prevented all growth of contaminants. A 1:1,250 dilution also completely inhibited the contaminants but had no effect on the tubercle bacilli. A 1:2,500 diamine dilution no longer affected the contaminants.

When diamine was diluted in weak sodium hydroxide, it completely inhibited tubercle bacilli and contaminants at a 1:1,250 final dilution with two negative guinea pigs. At 1:2,500 it markedly but not completely inhibited *M. tuberculosis* and two guinea pigs were positive, but it still completely inhibited contaminants. Contaminants were no longer affected at 1:5,000.

In the second experiment (see table) final dilutions of 1:2, 1:10, and 1:50 of the same highly positive sputum contacted diamine which was diluted from a 2 percent diamine, 95 percent isopropyl alcohol stock solution throughout the test ranges with distilled water only. Before culturing, one portion of each diamine-sputum mixture was diluted 100 times in water containing 0.05 percent potassium ricinoleate. Cultures were inoculated 45 seconds later and duplicate cultures were made after the other portion of each mixture had been diluted in 0.05 percent potassium ricinoleate containing 1 percent sodium hydroxide. This technique in a whole sputum test minimizes the action of sodium hydroxide, save for its effect on contaminants. The sputum-water controls were cultured 45 seconds after dilution in 1 percent sodium hydroxide.

In the table the growth inhibiting capacity of

Whole sputum test with diamine (N-dodecyl-1, 3-propanediamine) using 3 sputum dilutions

Final sputum dilutions in test	Highest final diamine dilutions causing complete growth inhibition of			
	<i>Mycobacterium tuberculosis</i> —diluent before culturing contained		Sputum contaminants—diluent before culturing contained	
	No NaOH	1 percent NaOH	No NaOH	1 percent NaOH
1:2-----	¹ 1:250	1:500	1:1,000	² 1:2,000
1:10-----	1:1,000	1:1,000	1:4,000	² 1:32,000
1:50-----	1:4,000	1:4,000	1:16,000	² 1:64,000

¹ This final diamine dilution contained just under 20 percent by volume isopropyl alcohol which undoubtedly reinforced the 1:250 diamine action. The alcohol concentration in the other diamine dilutions is considered inconsequential.

² Not run at higher dilutions.

diamine against sputum is shown to be a function of the amount of sputum contacted by the germicide. This is a rigorous test considering the high content of organic matter and tubercle bacilli in this sputum. There were over 200 colonies per control tube for sputum diluted 50 times. Under practical conditions contamination with the quantity of tubercle bacilli represented by even the 1:50 dilution would be the exception.

The brief contact of the 1:2 and 1:10 sputum controls with 1 percent sodium hydroxide almost, but not completely, checked the growth of non-acid-fast organisms in cultures from these specimens (not shown in the table). The same contact for all diamine-treated sputums caused complete decontamination, which indicates that even the most dilute diamine employed had some effect on these extraneous organisms. This test again shows that diamine works more effectively against contaminants than against *M. tuberculosis* in sputum.

The effect of diamine on concrete surfaces was evaluated in three experiments. Fairly rough and absorbent concrete stepping stones were used. The pH of concrete, determined by swabbing areas with water and rinsing the swabs in the same water several times, approximated 9.0 in a number of tests, and these surfaces were also shown to have some buffer capacity. This should theoretically make concrete a favorable surface for decontamination by diamine.

The effect of sodium hydroxide was definitely exaggerated in the first two experiments, which is considered permissible because one can well use sodium hydroxide with diamine when disinfecting a concrete floor.

In the first experiment 0.2 ml. volumes of sputum were applied to the rectangles. Considerable sputum soaked into the concrete and drying was rapid. After the sputum had dried, 2 ml. of a turbid aqueous diamine suspension was flooded slowly over each rectangle during a 3-minute period. The diamine was spread evenly with a swab as it was applied. Much of it was absorbed by the concrete and the swab removed most of the excess. After 20 minutes a new swab was dipped into 40 ml. of 0.25 percent sodium hydroxide, the rectangle was swabbed, and the swab rinsed in the sodium hydroxide. This was performed 5 times and the

resultant mixture of diamine, sputum, and sodium hydroxide was left at room temperature until all areas had been treated and swabbed, then 6 cultures were inoculated from each mixture. Control areas were flooded with water instead of diamine and likewise swabbed into sodium hydroxide.

The test was run on duplicate concrete surfaces, and the cultures of control areas developed over 300 colonies per tube. The highest dilution of diamine that caused complete growth inhibition was 1:5,000 for one surface and 1:2,500 for the other. In the latter instance 1:5,000 diamine produced almost complete inhibition.

In the second experiment 1:500 and 1:5,000 aqueous diamine dilutions in 1.5 ml. volumes were slowly flooded on concrete rectangles and allowed to dry. Two hours later 0.05 ml. amounts of positive sputum were spread over the treated and control areas and were left overnight at room temperature. The test was completed on the next day as in the first experiment.

Control colonies approximated 50 per tube, but no growth appeared in cultures from the 1:500 and 1:5,000 diamine-treated rectangles. This experiment also contained tests with 1:500 diamine made up in half saturated urea and further diluted to 1:5,000 with water, and 1:500 diamine in 2 percent Clorox which was likewise further diluted. Urea favors diamine solution and, as dried urea is slightly deliquescent, it was thought that this mixture might be more effective than aqueous diamine only. This was not proved although diamine in urea also caused complete inhibition at 1:500 and 1:5,000 concentrations. The diamine-Clorox mixtures were incompatible and separated. Even the preparation of 1:500 diamine and 2 percent Clorox failed to cause complete inhibition of growth.

The last experiment was planned to test the residual action of diamine that had been dried for varying periods on concrete and glass surfaces and to minimize the effect of sodium hydroxide. Diamine was diluted in water, from a clear stock solution of 2 percent diamine in 99 percent isopropyl alcohol and 3 percent Triton X-100 to final concentrations of 1:300, 1:1,000, and 1:3,000. Rectangles on glass and concrete were flooded with 0.25 ml. to 0.4 ml. of these

dilutions. The concrete rapidly absorbed most of the diamine before drying, but diamine concentrated on the glass surfaces by evaporation. The surfaces were stored in the dark at room temperature for 11 days, then like areas were prepared and allowed to dry for 4 hours. At this time sputum containing tremendous numbers of tubercle bacilli was diluted 10 times in water and placed in 0.05 ml. volumes on each treated area and on untreated control rectangles. The surfaces were stored overnight in the dark. Half of the treated surfaces were then swabbed 3 times and rinsed in 10 ml. of water and immediately inoculated on 3 cultures, while the other treated areas went through 0.5 percent sodium hydroxide before culturing. Some guinea pigs were inoculated from the concrete surface mixtures at the time that cultures were made. Half the control areas were treated with 0.5 percent and the remainder with 1 percent sodium hydroxide.

Control cultures from both glass and concrete developed over 200 colonies of *M. tuberculosis* per slant and many of these cultures from concrete also showed non-acid-fast contaminants.

None of the glass surfaces, including control areas, yielded growth of non-acid-fast contaminants. Cultures from glass areas on which sputum had been placed 4 hours after diamine were also all negative for *M. tuberculosis* through the 1:3,000, or highest diamine dilution.

When diamine had remained on glass for 11 days before sputum was added and the areas were swabbed and diluted with sodium hydroxide, growth of tubercle bacilli was completely inhibited by the 1:300 and 1:1,000 and almost completely inhibited by the 1:3,000 diamine dilutions. When water was used for final swabbing and dilution, complete growth inhibition was produced by only the 1:300 concentration of diamine. Dilutions of 1:1,000 and 1:3,000 caused marked and moderate degrees of inhibition, respectively.

Results of this test on concrete were disappointing. Probably insufficient volumes of diamine were applied, which mostly soaked into the concrete and was no longer available to contact the sputum.

Diamine on concrete in 1:300 concentration

for 4 hours completely inhibited growth on cultures and 4 guinea pigs were negative for tuberculosis. The 1:1,000 strength caused marked though not complete inhibition when swabbed and rinsed with sodium hydroxide but only moderate inhibition when treated with water.

Diamine on concrete for 11 days gave only a moderate degree of inhibition under both methods of final swabbing and dilution at 1:300, and 2 guinea pigs were positive for tuberculosis. No evidence of activity was apparent for the 1:1,000 concentration.

Toxic and Sensitizing Properties

A few preliminary tests on toxicity, skin irritability, and sensitizing properties of diamine were performed.

Intravenous injection of diamine into mice caused rapid death in a dose of 150 mg./kg., but 30 and 60 mg./kg. were tolerated and the mice appeared healthy 3 days later. Diamine was rather irritating by intraperitoneal injection, in doses as low as 40 mg./kg., into mice and killed all animals tested within 24 hours.

Two guinea pigs received 1 to 1.5 ml. of 1:300 diamine by stomach tube, lost weight for several days, and died. Another pig given a like volume of 1:1,000 diamine survived and gained weight for 2 months.

Diamine was not found to be unduly irritating to the skin in dilutions that might be used for practical disinfection. One volunteer rinsed his hands with 1 to 0.2 percent diamine many times for more than a year and has often allowed it to dry without any effect other than a slight tingling sensation. A 10 percent solution, allowed to dry on the forearm, produced a mild inflammatory reaction followed by slight desquamation.

Diamine is definitely irritating on intracutaneous injection. This was shown in two guinea pigs which, however, failed to develop measurable skin sensitivity to diamine under the following conditions. They first received 0.05 ml. intradermal diamine doses in 1:100, 1:300, 1:1,000, 1:3,000, and 1:10,000 dilutions. The 1:3,000 strength caused a minimal necrosis and this dose was repeated 3 times weekly until 9 such injections had been given. After a 19-day rest another 1:3,000 dose caused reac-

tions indistinguishable from previous responses to this concentration (4).

Diamine Compared With Phenolic Disinfectants

Sputum film tests have been run in this laboratory on several phenolic disinfectants (5). Exposure of films to disinfectants was 30 minutes, and the final diluent contained 0.25 percent sodium hydroxide. The highest dilutions of three representative phenolic preparations that caused complete growth suppression were:

Liquor Cresolis Saponatus U.S.P. 1:200.

Lysol (Lehn & Fink Products Corp.) 1:200.

Amphyl (Lehn & Fink Products Corp.) 1:400.

As shown in the present report, 1:2,500 diamine produced complete growth inhibition under the same conditions excepting that the final diluent contained 0.5 percent sodium hydroxide.

Conclusions

Under natural conditions of contamination and infection, *Mycobacterium tuberculosis* is always accompanied by exudate. N-dodecyl-1,3-propanediamine (diamine) is shown to be an efficient disinfectant of tuberculous exudate. This is especially true when diamine is incorporated in weak sodium hydroxide. The evidence was developed by rigorous methods in which cultural results have been supported by animal infection tests.

Diamine has an even greater growth inhibiting power for sputum contaminants and also, from unreported experiments, for heavy concentrations of *Escherichia coli* and *Micrococcus pyogenes* var. *aureus*. Hence, it can be considered a growth inhibiting agent with a wide antibacterial action although its effectiveness against spore formers is not known.

The dried film and moist sputum testing procedures imitated the two varieties of contamination likely to occur. Each method has advantages and disadvantages. That the results using either technique were not far apart makes it possible to obtain the advantages of both. Thus, washing diamine from the film did not reduce its effectiveness, and the somewhat uncertain findings for film disinfection by

diamine plus sodium hydroxide were corroborated in the surer moist sputum technique.

The experiments with the use of diamine on contaminated surfaces, limited to concrete and glass, suggest that similar results might be expected for other smooth, inert, or alkaline surfaces.

It seems reasonable to employ the sodium hydroxide-containing preparation at a diamine dilution of 1:1,000 for heavily contaminated articles such as specimen bottles and emesis basins. For less heavily contaminated areas such as floors in the immediate vicinity of patients, bed frames, bedside tables, and laboratory surfaces, a dilution of 1:2,500 is suggested. A dilution of 1:5,000 would seem adequate for surfaces possibly, but not probably, contaminated, such as sanatorium and hospital floors and counters in general. A minimum contact period of 30 minutes is recommended.

If applications to fixed surfaces are not rinsed but allowed to dry in situ, an additional advantage should be gained. A smooth, inert, or alkaline surface mopped twice weekly should maintain a considerable disinfecting potential, especially if soap is not employed.

Sodium hydroxide should be incorporated with diamine unless the resultant alkalinity is contraindicated, in which case strengths from 1:250 to 1:1,000 are recommended.

Diamine is not recommended for the routine disinfection of sputum. The intimate mixing required for a sure effect would be entirely impractical. For extreme accidental contamination, such as the spilled content of a specimen bottle, the area should be flooded with concentrated diamine solution (1:200 approximately) containing sodium hydroxide, the disinfectant and the contaminating material should be mixed well and the entire area covered with newspapers or similar material for at least an hour.

Summary

The disinfectant action of N-dodecyl-1,3-propanediamine (diamine) against highly positive tuberculous sputum was evaluated in several ways. Its activity, particularly in the presence of sodium hydroxide, was high.

Diamine has a broad spectrum antibacterial

action. It inhibits the growth of sputum contaminants more effectively than that of *Mycobacterium tuberculosis*. Its activity against bacterial spores, however, is not known.

Diamine does not appear to be an undue skin irritant. While no sensitizing ability was found, this possibility should be kept in mind. It appears promising as a surface disinfectant for tuberculosis hygiene and probably for more general sanitation also.

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Record Number Rehabilitated

A record number of 66,273 handicapped persons were restored to productive employment through the State-Federal vocational rehabilitation program during the fiscal year ending June 30, 1956.

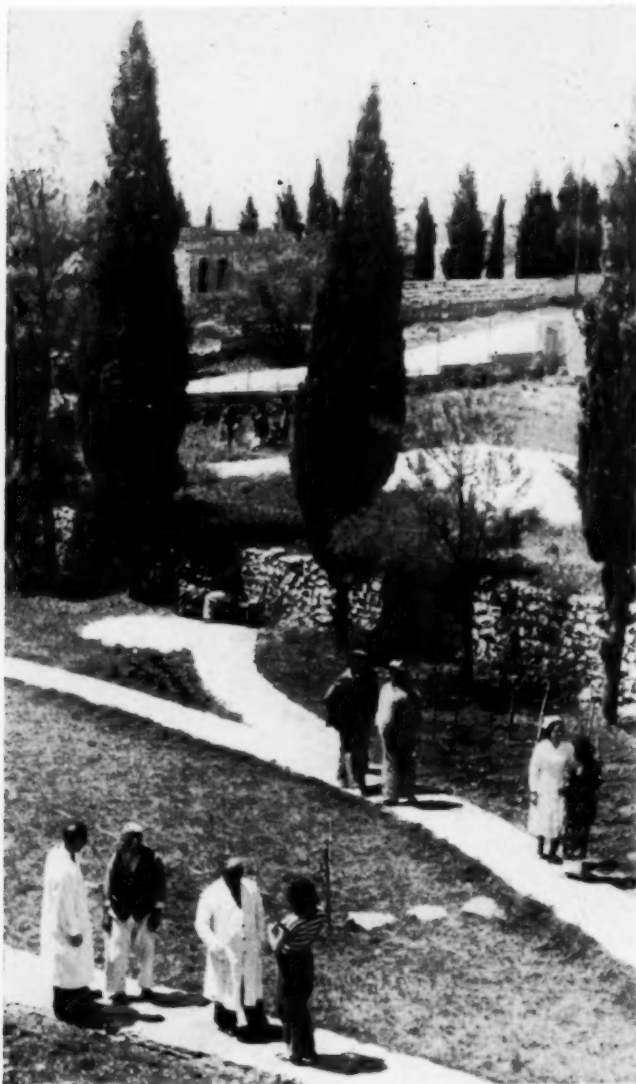
This was the highest total since the start of the public rehabilitation program in 1921 and was about 14 percent above the 57,981 rehabilitated in fiscal 1955.

The record figure includes 65,640 persons restored to employment directly through the State-Federal vocational rehabilitation program. The other 633 persons were placed in jobs through specific projects such as rehabilitation centers and shelter workshops developed jointly by community organizations and State rehabilitation agencies and financed, in part, by Federal grants.

Of the total rehabilitated last year, approximately 3,500 entered such "shortage" professional fields as education, medicine, and engineering. About 8,200 are in skilled trades, and approximately 6,200 work on farms. Most of the others are in managerial, sales, and service jobs or in unskilled work.

Roughly 13,000 of those rehabilitated had been dependent on public assistance immediately prior to or during the rehabilitation process and had been receiving approximately \$11.1 million a year in aid payments. The total cost of rehabilitating these people was \$9.2 million.

More than 48,000 of the rehabilitants were unemployed at the time they began receiving rehabilitation help, and most of the others were in unsafe, part-time, or otherwise unsuitable jobs or were in danger of losing their jobs because of disability.



Public Health Nurses in Israel



Hadassah medical organization nurses shown in some of their activities. *Above:* A "home call" to a roving Bedouin family is made to arrange for delivery of an expected child at the modern Beersheba hospital. *Left:* Patients at Safad's restored tuberculosis hospital find the garden a pleasant place for nurse consultation. *Below:* At Kiryat Yovel, a nurse joins the queue of families awaiting inoculations at this project for family-centered treatment.

Photographs: Hazel Greenwald



Death Certificate Statement of Occupation: Its Usefulness in Comparing Mortalities

By ROBERT BUECHLEY, M.A., JOHN E. DUNN, Jr., M.D., M.S.P.H.,
GEORGE LINDEN, M.P.H., and LESTER BRESLOW, M.D., M.P.H.

SEVERAL STUDIES have indicated occupational factors in the occurrence of various chronic diseases. One may cite "chimney sweep's cancer" (1), lung cancer among chromate workers (2), and, more recently, higher rates for coronary heart disease (3) among London bus drivers as compared with bus conductors.

It would seem possible that a comprehensive survey of the frequency of other diseases among all occupations as recorded on death certificates, relating these to the numbers of persons in the occupations enumerated by the census, would provide valuable epidemiological leads—that is, the formulation of hypotheses about the occupational origin of certain diseases.

Such studies would require much detail and accuracy, both in the coding of cause of death and in the coding of occupation. After more than a half century of codification and revision,

the International Statistical Classification of Diseases, Injuries, and Causes of Death has become a workable and consistent tool, with sufficient detail and sufficient accuracy for the purpose. This detail and accuracy has been achieved by querying causes of death that are ill defined or not understood and by a coding system that requires definite and unambiguous statements.

For the other axis of classification, occupation, two major coding systems have been developed in the United States since 1850: The Dictionary of Occupational Titles developed by and for the United States Employment Service and the system developed for the Bureau of the Census by Dr. Alba M. Edwards and others. These systems agree only in broad categories. Furthermore, the occupations reported on death certificates are not routinely coded and thus are not policed for completeness and accuracy as are reported causes of death. This has led to distrust of the accuracy of the occupation entries and to a natural reluctance to use the entries even in the search for epidemiological leads. Only by use, coding, and querying will occupation reporting increase in accuracy.

The only population base available by occupation for computation of rates is that provided by the decennial census enumeration. As we will point out, the definition for occupa-

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tional classification on death certification and census enumeration are different. A major epidemiological consideration is the degree of agreement between these two entries in spite of the differences in definition.

Materials of the Study

The present study was undertaken by the bureau of chronic diseases, California State Health Department, to examine the errors resulting from the present, less than perfect, occupation reporting on death certificates. Though based on a chunk sample, the study offers evidence and conclusions which may be of some use. A recent investigation of lung cancer (4) made available life-long occupational data on certain persons. We took the opportunity to compare these data with death certificate statements of occupation for the same persons.

During 1949, 1950, and 1951, trained occupational analysts took complete occupational histories from 518 lung cancer patients and 518 control patients. The patients, ranging in age from 30 to 80 years, were located in university, county, private, and Federal hospitals. Patients in these hospitals came largely from the middle and working classes of the California population so that professional and managerial classes were under-represented. Since most of the hospitals were in urban areas, the farming population was also poorly represented.

The men in this group were followed through the death indexes of the California Department of Public Health for 1949 through 1952. Four hundred and twenty-three male deaths of all ages (mostly of the lung cancer cases) were found. A copy of the death certificate was obtained for each death and was attached to the occupational history form. Only the 304 males aged 35 to 64 were used for the balance of this study. Persons under 35 are often not "settled" in any occupation, and there are relatively few deaths from chronic disease occurring in this age range. Since persons 65 and over are frequently retired or have taken terminal occupations, only incomplete and less satisfactory population counts by occupation are available from the census enumeration for rate computations in this age group.

Assigning Occupational Categories

Before working out the problems in comparing death certificates and occupational histories when using closely specified occupations, it is necessary to know what is meant by occupation. Unfortunately, defining occupation is in itself a major problem. Besides the two coding systems noted, several assignment methods or definitions are used in various special fields. There is in addition the complete occupational history of the person concerned. For purposes of clarity, it seems desirable to list and explain the definitions and the five methods this study used for assigning individuals to occupation categories.

1. The entry of occupation on the death certificates often is the raw material in any study of death rates by occupations. Instructions in California and in most other States for entering occupations on death certificates are based on the model certificate proposed by the National Office of Vital Statistics of the Public Health Service. The actual entry, whether or not it is in accordance with these instructions, will be called "the death certificate occupation" or "the death certificate entry."

2. The complete occupational history of the person concerned is a chronological list and description of occupations and lengths of time spent at each. This information has been recorded for the limited group of persons in the present study. For the purposes of this investigation, it will be assumed that the listing is correct although some memory loss, and perhaps bias occurred. This list will be called "the occupational history."

3. The census method of assigning a person to an occupation is given in Bureau of the Census publications (5). It is an operational definition, derived from answers to the question, "What kind of work was he doing . . . at the job he held during the census week? . . . at the last job he held [if he were unemployed]?" In effect, then, the occupational populations derived from the census enumeration, to which the death certificate occupations need be related for the computing rates, are based on last occupation. This method will be called the census method, and the occupation derived from it will be called "the last occupation."

4. The National Office of Vital Statistics,

which recommends the rules for death certificate entries, defines the "usual occupation" of an individual as "the job he pursued for the longest part of his working life" (6). This will be called the NOVS definition, and the occupation derived from it will be called "the usual occupation."

5. Finally, on a trial basis, this study uses another method of assigning individuals to occupations. Epidemiological considerations require that the occupation be pursued for a sufficiently long time so that the exposure to the occupational environment can be expected to initiate pathological processes. There is no single answer to "how long is long enough?" but 5 years is offered as an estimate for chronic conditions. Thus, any jobs held for a total of 5 years or more will be called "the exposure occupations." Any one individual, therefore, can, according to this definition, appear in more than one occupational category.

All the occupations and identifying industries worked in for 5 years or more were abstracted from the occupational history onto a 3" x 5" card. This was accomplished by using the 3-digit numerical codes for occupation and industry in the Census Bureau's "Alphabetical Index of Occupations and Industries" (7).

Three classes of occupations were determined from the occupational history. These were (a) the usual occupation, determined by the NOVS definition, (b) the last occupation, determined by the census method, and (c) all the exposure occupations (frequently more than one for each individual), determined by the exposure method. These chosen occupations were also entered on the 3" x 5" card. Industry identification was used only as an aid to coding the occupation.

After the occupation codes had been entered from the occupational history, the occupation and industry from the death certificate were copied verbatim onto the card and then coded according to the 3-digit numerical code. If the code numbers for occupation agreed with respect to all 3 digits, the agreement between occupational history and death certificate entry was considered perfect. Agreement failed, however, when the death certificate and occupational history entries did not agree in respect to all 3 digits.

The number of cases having 3-digit agreement by each of the three methods is shown.

	Cases
All three methods.....	141
Usual occupation and last occupation but not exposure occupation.....	0
Usual occupation and exposure occupation but not last occupation.....	14
Last occupation and exposure occupation but not usual occupation.....	45
Usual occupation only.....	0
Last occupation only.....	26
Exposure occupation only.....	11
No agreement.....	67
Total number of cases.....	304

The percentage agreement for the "usual occupation" method is 51.0

$$\frac{(141 + 14)}{304} = \frac{155}{304} = 51.0$$

For the "last occupation" method, it is 69.7

$$\frac{(141 + 45 + 26)}{304} = \frac{212}{304} = 69.7$$

For the "exposure" method it is 69.4

$$\frac{(141 + 45 + 14 + 11)}{304} = \frac{211}{304} = 69.4$$

The tabulation shows that there is a stable core of 141 persons (46.4 percent) with one and only one occupation determined on their occupational history, no matter which method is used. To this core are added special classes of persons to make up each total. Agreement in terms of usual occupation adds only 5 percent to this core. Last and exposure occupations show almost a 90 percent overlap, that is, the last occupation is usually held for 5 years. The highest percentage agreement is found with the last occupation method, a rather surprising result in view of the plain request for usual occupation on the death certificate.

Our finding indicates that to the people who furnish the information for entry on the death certificate "occupation" seems to mean current or present occupation. This finding appears to be true even if this last occupation is a short-time (less than 5 years) occupation, which tends to increase the number of last occupations reported correctly. The poor agreement of usual occupation apparently results from a tendency to ignore previous occupations if the last occupation has lasted several years.

Table 1. Degree of 3-digit agreement between death certificate statement of occupation and last occupation, in broad socioeconomic groups

3-digit occupations from death certificates		Socioeconomic groupings of 3-digit last occupations from occupational histories									
Socioeconomic group	Number of reported cases	Professional	Farmers and farm managers	Proprietors, managers, and officials	Clerks	Sales	Crafts	Operatives	Service	Farm labor	Labor, excluding farm and mine
Professional	24										
Agree	16	16									
Disagree	8	2		1	1		3	1			
Farmers and farm managers	11										
Agree	5		5								
Disagree	6			1				2		2	1
Proprietors, managers, and officials	17										
Agree	13			13							
Disagree	4					3			1		
Clerks	14										
Agree	10				10						
Disagree	4					2			2		
Sales	22										
Agree	16					16					
Disagree	6		1	1	1		1	1	1		
Crafts	92										
Agree	69						69				
Disagree	23					1	5	8	3	1	5
Operatives	36										
Agree	22							22			
Disagree	14			1	1		4	4		2	2
Service	44										
Agree	36								36		
Disagree	8								7	1	
Farm labor	4										
Agree	3									3	
Disagree	1							1			
Labor, excluding farm and mine	33										
Agree	22										22
Disagree	11							5	4	1	1
Unknown and not in labor force	7										
Agree	0										
Disagree	7				1	1		3	1		1
Total	304	18	6	17	14	23	82	47	55	10	32
Agree	212	16	5	13	10	16	69	22	36	3	22
Disagree	92	2	1	4	4	7	13	25	19	7	10

Choosing the Method of Assignment

As indicated previously, the populations by occupation provided by census enumeration are based on last occupation. The validity of mortality rates by occupation, which are based on entries of occupation on death certificates on one hand and census enumerations on the other, is dependent on the degree to which death certificate entries represent last occupation. Fortunately for our purposes here, although in dis-

regard of instructions, death certificate entries are most apt to be last occupation and not usual or some other prior occupation. The remainder of our presentation, therefore, will be concerned only with the agreement between last occupation revealed by occupational history and that entered on the individual's corresponding death certificate.

We attempted to group occupations according to a 2-digit code rather than the 3-digit

census code. This method resulted in 72 percent agreement on last occupation as against the 69.7 percent agreement with the 3-digit code. Further improvement in agreement, with loss of occupational precision, results from the use of 1-digit or social class code. This would give 76 percent agreement, as can be calculated from table 1. It does not appear that this increased agreement would be worth the loss of precision. In addition, these broad groupings are more socioeconomic than occupational, and thus exposures peculiar to specific occupations would be lost.

Another means by which agreement could be improved would be to code on environmental exposure, cutting across socioeconomic strata. This method would require groupings on the basis of similar exposure, such as grouping together "farmer" and "farm laborer," widely separated in the census system, or grouping together "aviator, army" and "aviator, commercial," also widely separated. Such a plan would entail development of a completely new coding system on exposure and would be entirely different from the approach with which this study

began. Hence, the 3-digit census codes are used as the basis of agreement or nonagreement for this study.

Accuracy of Reporting

Only a very few of the many individual occupations are present in sufficient numbers to be treated individually. Grouping these by broad socioeconomic groups, though admittedly not the ideal method, allows some estimates of the variability of reporting accuracy to be made.

Table 1 presents the death certificate occupation, as taken from the death certificate, in comparison with the last occupation, as taken from the occupational history. It attempts to give a concise report of the occupation shifts observed. Although occupations are grouped into the 10 socioeconomic groups used by the Bureau of the Census, it should be reemphasized that percent agreement is by detailed, 3-digit codes. The failures of agreement are of two kinds: upgrading and frank errors.

As evidence of errors of the first kind, the

Table 2. Comparisons between numbers designated as having a specific 3-digit occupation determined from occupational history, and the 3-digit occupation determined from death certificate entry

Occupational group	Correct number from occupational history	Number and percent designated on death certificate		Number and percent of death certificate occupations correct on a 3-digit basis		
		Number	Percent of correct number ¹	Number	Percent as designated on death certificate ²	Percent of correct number from occupational history ³
	(a)	(b)	(c)	(d)	(e)	(f)
Professional.....	18	24	133.3	16	66.7	88.9
Farmers.....	6	11	183.4	5	45.5	83.3
Managers.....	17	17	100.0	13	76.5	76.5
Clerks.....	14	14	100.0	10	71.4	71.4
Sales.....	23	22	95.6	16	72.7	69.6
Crafts.....	82	92	112.2	69	75.0	84.1
Operatives.....	47	36	76.6	22	61.1	46.8
Service.....	55	44	80.0	36	81.8	65.5
Farm labor.....	10	4	40.0	3	75.0	30.0
Other labor.....	32	33	103.2	22	66.7	68.8
Total.....	304	⁴ 297	97.7	212	69.7	69.7

¹ Column $b \div a \times 100$.

² Column $d \div \text{column } b \times 100$.

³ Column $d \div \text{column } a \times 100$.

⁴ Includes 7 for whom no occupation was designated.

number of entries above and to the right of the diagonal in table 1 is larger than the number below and to the left. There is movement upward into professionals, managers, and craftsmen from operative and service occupations. Death certificates placed 45 persons in "higher" occupations, socioeconomically, than warranted, and placed only 21 in "lower" occupations.

Frank errors occur throughout table 1 in a somewhat random manner. They are also responsible for the anomaly of persons coded to the correct socioeconomic group but not to the correct occupation within the group, for example, an actor reported as an aviator or a painter reported as a carpenter. While social class is correct for these occupations, environmental exposures may be completely incorrect. Another feature is the variability between groups in proportion of agreement. This is further presented in table 2, which is a summary and extension of part of table 1.

Several comparisons between persons known from occupational history to have specific occupations and those designated with these specific occupations on death certificates are shown in table 2. Columns *a*, *b*, and *c* of the table indicate the order of magnitude of the error in the number of deaths attributed to an occupation compared with what this number should be. It is of some interest to know the numerical error in the numerator of a rate even though a portion of this number may include the wrong persons. The greatest error is for farmers and farm laborers, with over 80 percent excess in the former and 60 percent deficiency in the latter. The obvious explanation would seem to be the upgrading of farm laborers to farmers on death certification. This is partially true but, as can be seen in table 1, misreporting out of and into these categories is not quite that simple and direct. As might be expected, the professional category of occupations has the next highest excess, which is largely a result of upgrading on death certificates, as can be seen in table 1. The other occupational categories are considerably closer to their correct number, with only operatives and service workers deviating as much as 20-25 percent. The actual rates of mortality from death certificates for such categories as managers, clerks, salesper-

sons, and craftsmen will not be severely biased because of excessive or inadequate numbers of deaths attributed to the specific occupations in these categories.

Columns *d* and *e* in table 2 show that on the average about 70 percent of those persons designated on death certificates as having a specific occupation will actually have had the occupation. The range is from 45.5 percent for farmers to 81.8 percent for service workers. Column *f* of table 2 gives the percentage of those persons who have a specific occupation on their occupation history that is identically designated on their death certificates.

The essential proportions for anticipating and interpreting data from the use of occupation on death certificates in the search for abnormal risk of fatal disease are contained in columns *c* and *f* of table 2. Column *c* indicates the degree and direction of bias for mortality rates where, owing to misreporting, the percentage deviation from 100 is unrelated to occupation. For example, occupations in the professional category would be one-third excessive, operatives would be 23 percent deficient, and managers and clerks would be approximately correct. However, in the case of a specific occupation carrying an increased risk of disease, the excess deaths would be retained in the specific occupation on death certificates according to the proportions given in column *f*.

Conclusion and Summary

At the present it must be admitted that searching for increased risk of specific causes of mortality in specific occupations through death certificate occupational entries is a rather crude and somewhat insensitive method. However, those who are interested have an excellent chance of recognizing increased risks of the order of several fold by this approach. It is also likely that a significant increased risk, when found, will understate the true risk.

Analysis of death rates by cause and by detailed occupation may reveal useful relationships. Cause of death is fairly accurately reported while occupation, not at present being routinely coded or "policed," is less accurate. The bureau of chronic diseases of the California State Department of Health had interviewed a

group of lung cancer patients and controls and had obtained their occupational histories. To study the limitations inherent in the use of death certificates for occupational mortality studies, the occupation reported on the death certificate was later compared with the occupation reported in the interview. The study is based on a chunk sample, but it indicates the kind of results obtainable.

From comprehensive occupational histories, mostly of the lung cancer patients, 304 deceased men aged 35-64 were assigned to the 3-digit occupation codes used by the Bureau of the Census. A similar assignment of occupation codes was made for the occupations reported on the death certificates. Occupation was in agreement when the assigned 3-digit codes were identical. Out of a multiplicity of possible rules for assignment, three were applied to the occupational histories. These rules and the percentage agreements they generated are as follows:

"Usual occupation" method, the National Office of Vital Statistics rule—51.9 percent agreement.

"Last occupation" method, Bureau of the Census rule—69.7 percent agreement.

"Five-year exposure occupation" method, our own rule—69.4 percent agreement.

Despite a phrase on the death certificate defining usual occupation, the death certificate entries best represent last occupation. Because of this situation, because death rates must be computed by using death certificate populations for the numerator and census populations for the denominator, and because the denominator occupations are defined by the census rule for last occupation, we used the last occupation rule for the balance of the study.

By grouping occupations into 10 broad groups, though retaining 3-digit agreement, we obtained some idea of the variability of misreporting. Since it cannot be assumed that this variability is random, the specific net misreporting for each group must be used with caution. By considering the effects of positive association between a cause of death and an occupation, it seems evident that strong positive associations will show themselves despite considerable misreporting.

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Effects of Penicillin G In Vitro On *Hemophilus ducreyi*

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DURING the course of experiments at the Venereal Disease Research Laboratory on the treatment and prophylaxis of chancroid induced in human volunteers (1) and in animals, it was observed that therapy with oral penicillin G (Bicillin) did not aid recovery.

Previous reports have indicated *Hemophilus ducreyi* to be sensitive to penicillin in vitro (2-4) while in vivo experiments have demonstrated equivocal findings.

Deacon and associates (1), trying to confirm Willcox's theory that penicillin might be of value if given in such a manner as to produce and maintain high serum concentrations (5), found that penicillin G administered orally in five chancroid infected volunteers produced mean serum levels of only 0.025 penicillin G units per milliliter of serum. This concentration was not effective as a prophylactic agent for *H. ducreyi* infections. Treatment with orally administered penicillin V in five volunteers, however, resulted in a mean serum level of 0.232 penicillin G units per milliliter of serum, and lesions were definitely controlled during this treatment. Furthermore, if penicillin V was administered orally prior to inoculation with *H. ducreyi*, levels of penicillin G units per milliliter of serum reached a mean level of 0.492, and the volunteers either failed to develop lesions or developed very few lesions.

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In an effort to correlate Deacon's findings with in vitro results, the present study was undertaken. Our purpose was to determine the concentrations at which penicillin G inhibited the growth of *H. ducreyi* and the length of time at which concentrations of penicillin G inhibited growth.

Materials and Methods

Inoculum for all experiments was prepared by inoculating 5 ml. of casitone-saline medium (6) (1 percent Difco bacto casitone, 0.85 percent NaCl, plus 5 percent sterile rabbit serum), contained in 150 mm. x 20 mm. screw-cap test tubes (Kimble No. 45066), with a loopful of 24-hour *H. ducreyi*, strain CH1A (7), which is representative of virulent strains in our laboratory, grown in the same medium. Incubation of these cultures was at 34° C. for 16 to 24 hours. At the end of the incubation period, cultures were checked for purity by means of a Gram stain and subculture upon nutrient blood agar (7) (Difco nutrient agar 1.5 percent plus 5 percent defibrinated rabbit blood) plates. These plates were incubated at 34° C. in candle jars for 48 hours. The culture used as the inoculum was the same as used by Deacon and co-workers (1), had been checked previously for its ability to produce typical lesions in volunteers (1), was of known pathogenicity, and during manipulation did not lose pathogenicity.

To determine the concentration at which penicillin G inhibits the growth of *H. ducreyi*, nutrient blood agar plates containing concentrations of penicillin G from 0 to 20 units per milliliter of agar were inoculated with 0.5 ml. inoculum and the surface of the agar spread with sterile bent glass rods. These plates were incubated at 34° C. in candle jars for 48 hours. Colonies were observed, and Gram stains were made in order to observe morphology.

It was also desired to determine the length of time at which concentrations of penicillin G inhibited growth. Screw-capped test tubes, 150 mm. x 20 mm., with 10 ml. of casitone-saline medium and containing graded amounts of penicillin G were inoculated with a loopful of the *H. ducreyi* culture. One milliliter of 1,000 units of Difco bacto-penase (penicillinase) was added to each tube of each penicillin G concen-

tration medium at 0, 2, 4, and 6 hours. Separate tubes were employed for the penicillinase addition. Therefore, five tubes were used for each penicillin G concentration. The fifth tube was a control containing no penicillinase. The concentration of penicillinase used was sufficient to inhibit all concentrations of penicillin G used in this experiment and did not inhibit the growth of the organism when penicillin was absent or present.

Results and Discussion

Penicillin G inhibited the growth of *H. ducreyi* strain CH1A, at concentrations over 0.1 unit per milliliter of agar. Gram stains of cells of the 0.1-unit plates showed cells that were swollen and elongated to several times their normal size, which indicates that this concentration constitutes a sublethal dose (8). Growth was not inhibited, and subcultures of these organisms on nutrient blood agar without the drug resulted in normal appearing *H. ducreyi*. These results are shown in the following tabulation:

Penicillin G (units/ml. agar)	Type of cells
0.....	Normal chains.
.001.....	Do.
.01.....	Do.
.1.....	Swollen and elongated.
.2.....	No growth.
.3 to 20.0.....	Do.

Efforts to transfer normal and elongated cells to gradually increased amounts of the drug resulted in no detectable resistant organisms.

The results as shown in the following table indicate that inhibition is a relationship of concentration of penicillin G and the length of time *H. ducreyi* is in contact with the drug. Consequently, 0.1 unit of penicillin G per milliliter of casitone-saline medium did not inhibit growth after 24 hours; 0.2 units of penicillin G per milliliter of medium inhibited growth after 6 hours' contact; 0.3 units of penicillin G per milliliter of medium inhibited growth after 4 hours' contact; and concentrations of penicillin G of 0.4 units or more per milliliter of medium inhibited growth in less than 2 hours' contact.

In the liquid medium no swollen and elongated cells were observed at any concentration of the drug used.

Time at which concentrations of penicillin G inhibit growth of *Hemophilus ducreyi*, strain CH1A, grown in casitone-saline medium for 24 hours

Penicillin G (units/ml. medium)	Hours at which penicillinase was added				No peni- cillinase added
	0	2	4	6	
0.....	+	+	+	+	+
.1.....	+	+	+	+	+
.2.....	+	+	+	+	—
.3.....	+	+	+	—	—
.4.....	+	—	—	—	—
.5.....	+	—	—	—	—
.6.....	+	—	—	—	—
.7.....	+	—	—	—	—
.8.....	+	—	—	—	—
.9.....	+	—	—	—	—
1.0.....	+	—	—	—	—

+ indicates growth and no inhibition.
— indicates inhibition of growth.

All tubes were incubated an additional 24 hours and were read, with no changes in the results. Wetherbee and co-workers (2) cultured *H. ducreyi* in tryptose phosphate serum broth with various concentrations of penicillin G and subcultured the organism 24 and 48 hours on chocolate tryptose agar plates. They found that penicillin G inhibited at 0.1 to 0.5 units per milliliter at 24 hours but that there was less inhibition at 48 hours. This suggested to Wetherbee that penicillin prolongs the lag phase but is not significantly bacteriostatic. While Wetherbee and his associates did not demonstrate any significant bacteriostatic effect of penicillin G upon *H. ducreyi*, our results indicate actual bacteriostatic and bactericidal effects based upon concentration of the penicillin G and the length of time the drug had to act upon the organisms. In our laboratory, avirulent strains of *H. ducreyi* showed different sensitivities to penicillin G and other antibiotics than did *H. ducreyi*, strain CH1A, or other virulent strains. Therefore, it seems probable that the strains Wetherbee and co-workers used were avirulent.

Eagle (9) states that penicillin G is inactivated by serum in vitro. Our experiments showed that 5-percent rabbit serum did not inhibit the effect of penicillin G upon the organisms. This, of course, may be more apparent

than real. Some of the penicillin G may have been bound by some component of the serum, but the bactericidal effect is there, nevertheless.

Consequently, the sensitivity of this organism to penicillin G is an expression of the amounts which must be present in the medium in order to effect a binding with some cell constituent or constituents. Eagle and co-workers (10) interpret the binding of penicillin by bacteria to be determined by a single essential component, which is functionally inactivated by that combination which is normally present in significant excess. Schepartz and Johnson (11) propose that "binding occurs by cleavage of the beta lactam ring of penicillin and combination of the carbonyl or imino group of that ring with the binding component."

Our *in vitro* results can be compared with the *in vivo* results of Deacon and co-workers (1) in that, if the serum level of penicillin G is about 0.2 units per milliliter, that concentration should be sufficient to inhibit growth of *H. ducreyi*, strain CH1A, less than 24 hours after the patient's blood has attained this penicillin level. More immediate response would be expected if 0.3 or 0.4 units of penicillin G per milliliter of blood could be attained. Eagle and associates (12) state that the therapeutic action of penicillin is in a large part measured by the aggregate time for which it remains at effective levels at the focus of infection, that these effective levels *in vivo* are of the same order of magnitude as those effective *in vitro*, and that the effective penicillin time in the serum is usually a reasonable approximation of the penicillin time in tissue fluids.

While penicillin G can inhibit the growth of *H. ducreyi* *in vitro*, Deacon and co-workers (1) have shown that the serum penicillin G level does not attain the necessary concentration. Penicillin V, however, by increasing the serum penicillin G level, shows some usefulness in treatment of chancroid.

Summary

Penicillin G is bactericidal for *Hemophilus ducreyi*, strain CH1A, at concentrations over 0.1 unit per milliliter of medium. Inhibition of growth is dependent upon the concentration of the drug and the length of time at which the organism is in contact with the penicillin G.

A blood level of 0.3 or 0.4 units of penicillin G per milliliter should inhibit the growth of virulent *H. ducreyi* in 2 to 6 hours, and a level of 0.2 units of penicillin G per milliliter should inhibit the growth of this organism in less than 24 hours.

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Disability in Butler County, Pennsylvania

By SAXON GRAHAM, Ph.D.

THE EXTENT of disability in a large population, conceived as individual inability to behave adequately in consequence of disease or injury, has received relatively little investigation.

A definition of adequate behavior should perhaps be a philosophical one. But for the purpose of measurement, we may discern forms of behavior which are attributable to a physiological handicap. For example, disease or injury may contribute to breakdowns in the interpersonal relations between the individual and members of his family. It may prevent him from carrying on his usual occupation. It may force him into restrictions of diet. It may result in motor disabilities, which are the forms with which this paper is concerned. These include the inability of the individual to feed himself, to dress and groom himself, to walk without help, and to climb or descend stairs, and the necessity of being confined to the house or bed or of having to use a wheelchair or a crutch or cane to walk.

Such disabilities present a much more tangible problem to the community than illness per se. Illnesses are important to society mainly because of their potential for causing either death or disability. It is the death or disability resulting from illness or injury, rather than

the illness itself, which creates the burden of expense and the loss of productivity.

In 1954, we attempted to assess motor disability, as we have described it, in Butler County, Pa. We investigated the extent and duration of motor disability in the population and the frequency of various kinds of disability. Also, we attempted to associate a specific disease or injury with each disability.

Method of Inquiry

The data for this inquiry were obtained as part of comprehensive health studies in Butler County. They are based on a probability sample of 3,403 residents. The sample allowed for geographic stratification and the proportionate representation of urban, rural place, and open country population.

Butler County is directly north of Allegheny County, which includes Pittsburgh. Of its total population of about 103,000, 28.1 percent live in cities; 19.4 percent, in rural places; and the remaining 52.5 percent, in open country. Ethnically, the population is relatively homogeneous, an American mixture of people with European ancestry. There is a smaller proportion of foreign-born residents than would be expected on the basis of national statistics. Housing and sanitation present few, if any, serious trouble spots.

Interviewing, editing, and coding were carried on during the summer of 1954. Interviewing was conducted by women. They spoke with only one member of each household, who was requested to report on the conditions of all other members. Questions were asked regarding chronic disease, physical impairments, acute

Dr. Graham, assistant professor of medical sociology, department of biostatistics, University of Pittsburgh, is director of the Butler County health studies. These studies were initiated to examine the impact of the newly established county health department on the population of the county.

disorders, maternal and child health, nutrition, disabilities, sanitation, and sociological characteristics relevant to health. Specific queries were put as to whether individuals in the households in the sample had any of the motor disabilities mentioned above. When a positive answer was given, questions were asked as to the medical condition responsible for the disabilities.

Caution must be observed in the interpretation of the findings of this survey. It was impossible, for example, to determine the accuracy of statements interviewees made as to the medical reasons for the disabilities. Also, since only one member of the household was interviewed, there was no way of knowing for certain the actual status of anyone except that member. Nevertheless, comparison of the survey findings with those of the United States census of 1950 reveal close agreement on such nonmedical factors as the total number of persons in the county; the age and sex distributions of the population; the proportions of residents in open country, rural place, and urban areas; and the proportions having various amounts of education.

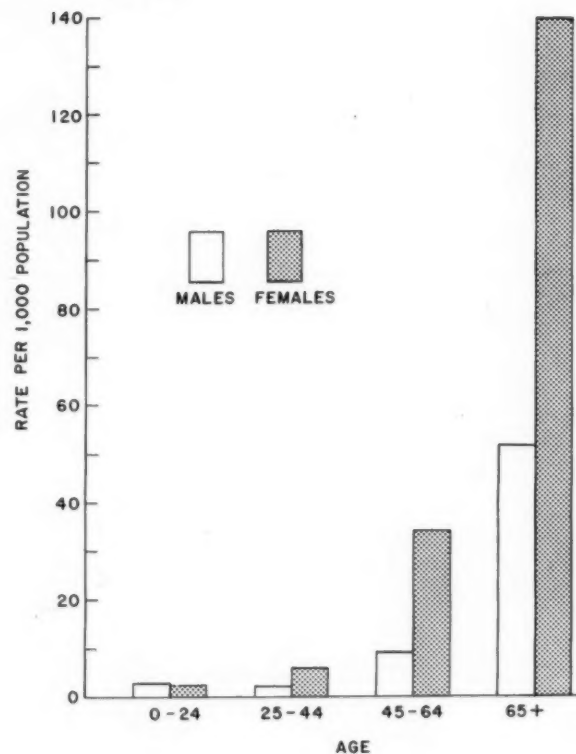
Estimated relative sampling errors for the more important statistics obtained in the health studies were as follows: a range of 3.7 to 7.7 percent for estimates of the numbers of persons in different age groups, 5.2 percent for the estimate of the number hospitalized in the year preceding the survey, and 13.2 percent for the estimate of the number of persons disabled.

Prevalence of Disability

Because of the lack of comparable data on disability in other areas, it is difficult to assess the situation in Butler County. Nevertheless, the number of people disabled, the proportion of households affected, and the duration of the disabilities found indicate that the problem is substantial.

Of the 3,403 persons in the sample, 54 had disabilities of the kinds investigated in the survey, a rate of 15.9 disabled persons per 1,000 population. These 54 people were afflicted with a total of 128 disabilities. The rate for persons with but one disability was 6.2 per 1,000 population; for those with 2 or more disabilities, it was

Figure 1. Age and sex distribution of persons having one or more motor disabilities, Butler County, Pa.



9.7. Of the 54 disabled persons, 61.1 percent had more than one disability. In sum, the prevalence rate for the disabilities examined in this study was 37.6 per 1,000 population.

The effects of disability, of course, are not confined to the individual who has it. They influence the whole family. Results of this study showed that a substantial proportion of the households in the county, 5.4 percent, had disabled persons among their members. One disabled person was found in 5.1 percent of the households, and 2 or more in 0.3 percent.

Another method of measuring disability is by its duration. If we sum the number of years each disabled person was unable to function optimally, we find that at the time of the survey 141.4 man-years per 1,000 population had been lost because of disability. About 1 person per 1,000 had been disabled 30 to 36 years. Almost 2 per 1,000 had been disabled 20 to 25 years, and about the same number had been disabled 10 to 15 years. The largest number, 6.2 per 1,000, had been disabled less than 5 years. The loss of the services of these disabled individ-

uals over many years, not to mention the fact that the community has had to support some of them, adds up to an important economic handicap.

The age and sex distribution of the 54 persons having disabilities, shown in figure 1, indicates that as age increases the proportion of persons disabled increases in rapid fashion, particularly among females. The rate of 2.6 per 1,000 for females under 25 years of age was about the same as the rate for males in this age group. However, for persons 65 and over, the female rate had increased to about 140 per 1,000, whereas the male rate had increased to only about 50 per 1,000. In every age group except the under-25-years one, more women than men were disabled. We must caution, of course, that here we are dealing with characteristics which appear relatively infrequently in the population. Estimates for prevalence by sex in the younger age groups have large relative standard deviations. However, estimates for the older age groups are more reliable, and the consistency of findings relative to sex in all age groups indicates a higher prevalence among females.

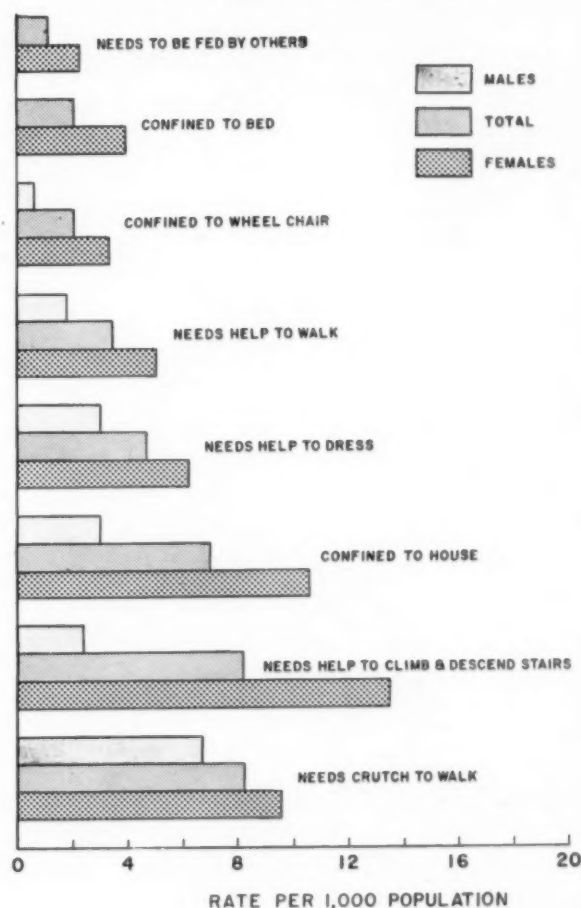
Types of Disability

Figure 2 shows the prevalence of various types of motor disability. The least frequent condition was having to be fed by another person. No males were in this category. The rate for females was 2.3 per 1,000; for all persons, it was 1.2 per 1,000.

Slightly higher was the prevalence of having to use a wheel chair; 2.1 persons per 1,000 were so incapacitated. Here again, most of the cases were found among females. Their rate of 3.4 per 1,000 was 5 times the rate for males. The rate for being confined to bed was also 2.1, and this disability existed exclusively among females.

Rates for the other disabilities increased from 3.5 for needing help to walk, to 4.7 for needing aid to dress, to 7.1 for being confined to the house, to 8.2 for having to use a crutch or cane to walk and for needing assistance in climbing or descending stairs. For every disability, the rate was higher for females than for males. The greatest difference between males and females was found for the inability to climb or

Figure 2. Prevalence of various motor disabilities, by sex, Butler County, Pa.

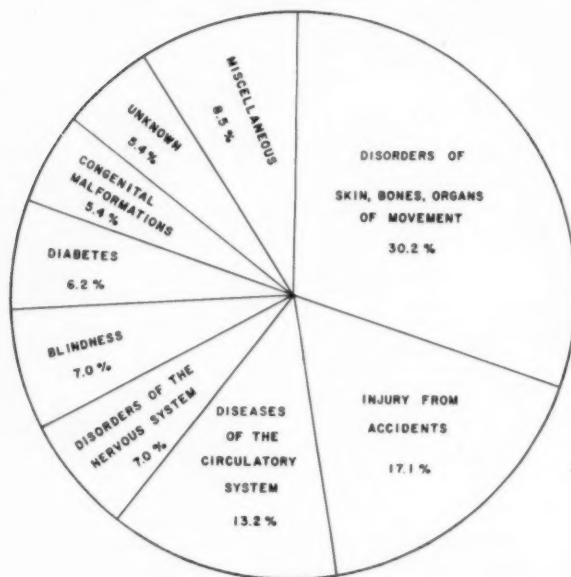


descend stairs without help. Here the rate for males was 2.5 per 1,000, and that for females, 13.6. The smallest differences between the sexes were found for the inability to dress without help and the need to use a crutch or cane to walk. For the former, the male rate was 3.1 and the female rate was 6.2; for the latter, the male rate was 6.7 and the female rate was 9.6. Again, these estimates have high relative standard deviations, and the magnitude of the rates should be interpreted with caution.

Causes of Disability

As shown in figure 3, conditions of the skin, bones, and organs of movement were mentioned as contributing to 30.2 percent of the disabilities. These conditions included pemphigus and especially arthritis. Injuries resulting from accidents were next most important, accounting

Figure 3. Medical conditions contributing to motor disabilities, Butler County, Pa.



for 17.1 percent of the disabilities. A large proportion, 13.2 percent, were attributed to conditions involving the circulatory system, particularly heart disease. Seven percent were caused by diseases of the nervous system, and the same percentage, by blindness. Diabetes was responsible for 6.2 percent of the disabilities, and congenital malformations, for 5.4 percent.

Twenty-four different types of medical conditions were cited as contributing to the motor disabilities. These conditions were mentioned as contributing to 128 disabilities in 54 disabled persons. Thus, a given medical problem in an individual caused, on the average, more than 2 motor disabilities. Four persons mentioned heart disease as causing them a total of 10 different motor disabilities. Arthritis was cited by 14 persons as contributing to a total of 26 disabling afflictions.

Summary and Conclusions

As public health scientists increasingly concern themselves with social well-being in addition to physical health, their interests will be focused more and more on problems such as the problem of disability. Disease in itself is a problem, but it is a liability to society mainly

when it causes a disability of one sort or another. When disability is defined as the inability of the individual to function adequately as a member of society, it immediately becomes a matter of first concern to public health.

The study in Butler County, Pa., based on a probability sample of 3,403 residents, gives some idea of the extent of motor disability. It was found that 15.9 persons per 1,000 population were afflicted and that more than 5 percent of the households had at least one disabled member. Disability was found more frequently among women than among men and more frequently among persons over 60 years of age than among younger persons. The disabilities of highest prevalence were the need for help in climbing or descending stairs and the need to use a crutch or cane to walk, each with a rate of 8.2 per 1,000. Next came being confined to the house (7.1), needing help to dress (4.7), requiring aid in walking (3.5), having to use a wheelchair (2.1), and being confined to bed (2.1). Having to be fed by another person was the least prevalent of the disabilities studied.

Among the medical causes of these disabilities, arthritis, injuries, and heart disease were prominent. Disabilities were typically of long duration, with one-third of the disabled population functioning less than optimally for from 10 to 36 years prior to the survey. The rate of man-years lost from optimal functioning because of disability was 141.4 per 1,000 population.

Undoubtedly, these figures underestimate the prevalence of disability, for they include only the disabled persons present in the households at the time of the interview. They do not include individuals who are disabled and living in institutions. For this and other reasons, caution must be exercised in interpreting the findings on disability in Butler County.

The Butler County study constituted an exploration of a subject about which we have little quantitative information. Apparently, the problem of disability is not negligible. Before we can assess it properly, we require better data on its magnitude, on the social and physiological factors which figure in its etiology, and on its costs to society in loss of production power and long-term expenditures for medical care.

Comparison of the prevalence and distribution of antibodies to Toxoplasma gondii in an urban and a rural population suggests that factors responsible for transmission of human toxoplasmosis are common to both groups.

Distribution of Toxoplasma Antibodies in Comparable Urban and Rural Groups

By COLVIN L. GIBSON, Ph.D.

ONE of the major gaps in our knowledge of human toxoplasmosis is the means by which man comes into contact with, and becomes infected by, the causative agent, *Toxoplasma gondii*. Numerous studies in various parts of the world have made it clear that serum antibodies to *T. gondii* are widely prevalent in humans, suggesting that infection is relatively common although frequently inapparent, but little information has been published regarding the environmental factors which may contribute to the spread of this infection.

A recent study by the author and his colleagues of a rural Negro population near Memphis, Tenn., gave a clear picture of the distribution of *Toxoplasma* antibodies in that particular group (1). It showed that the prevalence of antibodies is about the same in both sexes; that the titers fall into a bimodal distribution suggestive of a nonspecific reaction at the lowest titers; that the chance of finding

antibodies increases with age; and that young people tend to have higher titers than older people.

That study, however, did not allow us to pinpoint any of the factors that might be working to produce such a distribution of titers. Nor did it permit us fruitfully to compare that population with any other group. The present study was therefore undertaken to attack the question of environmental factors in the transmission of toxoplasmosis by comparing the antibody status of the rural Negro population with that of a comparable urban group.

Methods

Figure 1 shows the geographic region in which this study was made. The urban sample consisted of 627 serums taken at random from the students of a large junior-senior high school in the city of Memphis. The students, all Negroes, ranged in age from 11 through 19 years. The rural sample consisted of 445 serums from persons in the same age group, also Negroes, taken at random throughout Fayette County, but chiefly from the area south of the Wolf River, which is shown shaded on the map.

Most of the serums from the rural population which we tested in the present study were included in the larger rural sample, represent-

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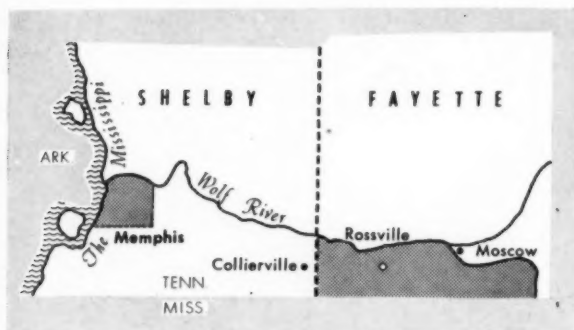


Figure 1. Location of urban and rural populations from which serums were collected. The urban sample was composed of Memphis residents; the rural sample, of Fayette County residents, chiefly those in the area south of the Wolf River.

ing 987 persons of all ages, analyzed in a previous report (1). In order to relate the present study of a restricted age group to the overall prevalence in rural Fayette County, we show in figure 2 the prevalence rates for all ages, as previously reported. Rates reported for other parts of the world by various investigators are also included for purposes of comparison. In general, the antibody prevalence in rural Fayette County was greater than the level found in England (2) but less than that found in the Netherlands (3), in Germany (4), and in Austria (5). In the present report we shall be concerned only with the small portion of the curve from 11 through 19 years of age.

All the serums in both our samples were tested by the Sabin-Feldman dye test. The technique originally described by these investigators, including inactivation at 56° C. for 30 minutes, was used (6). Serums were tested undiluted and at progressive fourfold dilutions (1:4, 1:16, 1:64, and so forth) until the end point was reached. Frequent comparative tests on unknown serums by our laboratory and several other research laboratories in the United States have always shown good agreement, a fact which lends confidence to our results.

Results

The results obtained by the dye test for each of the sample populations are summarized in the table.

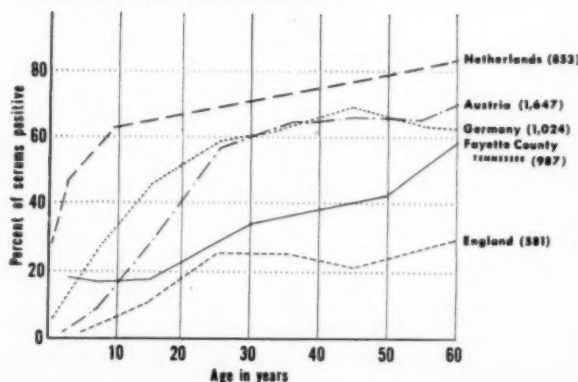
The prevalence of positive serums was 20.1 ± 2.3 percent for urban males and 20.7 ± 2.2 percent for urban females. Comparable rates for the rural group were 19.9 ± 2.6 percent for males and 17.8 ± 2.6 percent for females. Statistical analysis indicated that the slight differences in overall prevalence of positive serums between males and females in each population were not significant. (*P* values were 0.85 and 0.58 for the urban and rural groups, respectively.) Even when an analysis was made of each 1-year age group, no significant difference between the sexes could be detected. The greatest divergence occurred in the 11-year-old rural group, in which 24.3 percent of 37 males and 9.1 percent of 33 females were positive. Statistical analysis of these data using the formula

$$\sigma_A = \sqrt{(p \times q)/N_1 + (p \times q)/N_2}$$

gave a probability value of 0.09, which indicates that the observed difference between the sexes in this group probably is not significant. Since we failed to find a significant difference between males and females with respect to the prevalence of positive titers, data for the sexes were combined in all later calculations unless otherwise indicated.

One possible exception should be noted to the conclusion that there is no significant difference between males and females with regard to the prevalence of positive serums. For serums positive at the undiluted level, there was a highly suggestive difference between the sexes in the urban sample. Only 7 of 298 males (2.3

Figure 2. Prevalence of *Toxoplasma* antibodies by age, as reported for various parts of the world (1-5). Figures in parentheses show number of serums tested.



Distribution of serums positive for *Toxoplasma* antibodies by titer for urban and rural populations in Tennessee

Habitat and age in years	Number of serums tested	Number of serums positive							Percent of serums positive (all titers)
		Undiluted	1:4	1:16	1:64	1:256	1:1,024	All titers	
<i>Urban</i>									
11-----	13	0	0	0	0	0	0	0	0.0
12-----	70	6	1	6	3	0	0	16	22.8± 5.0
13-----	129	5	1	10	11	1	0	28	21.7± 3.7
14-----	101	4	1	8	6	2	0	21	20.8± 4.1
15-----	116	8	2	7	6	0	1	24	20.7± 3.8
16-----	102	4	0	7	5	1	1	18	17.6± 3.8
17-----	62	3	3	2	2	2	0	12	19.4± 5.0
18-----	25	0	1	2	1	3	0	7	28.0± 9.0
19-----	9	0	0	1	1	0	0	2	22.2± 13.9
Total-----	627	30	9	43	35	9	2	128	20.4± 1.6
Males-----	298	7	5	23	19	6	0	60	20.1± 2.3
Females-----	329	23	4	20	16	3	2	68	20.7± 2.2
<i>Rural</i>									
11-----	70	2	1	1	6	1	1	12	17.2± 4.5
12-----	62	3	3	3	4	2	0	15	24.2± 5.4
13-----	72	6	0	2	3	4	1	16	22.2± 4.9
14-----	63	3	2	5	2	1	1	14	22.2± 5.2
15-----	57	2	0	4	1	0	0	7	12.6± 4.4
16-----	42	1	0	1	1	2	0	5	11.9± 5.0
17-----	39	0	0	2	1	2	2	7	17.9± 6.1
18-----	33	0	0	3	4	1	0	8	24.2± 7.5
19-----	7	0	0	0	0	0	0	0	0.0
Total-----	445	17	6	21	22	13	5	84	18.9± 1.9
Males-----	231	6	4	12	14	7	3	46	19.9± 2.6
Females-----	214	11	2	9	8	6	2	38	17.8± 2.6

percent) had undiluted positive titers as contrasted with 23 of the 329 females (7.0 percent).

The difference between these rates is highly significant statistically ($P = 0.005$), but at present we cannot offer an explanation for this difference. A similar trend can be detected in the rural sample, in which 6 out of 231 males (2.6 percent) and 11 out of 214 females (5.1 percent) had undiluted positive serums, but the difference here is not statistically significant ($P = 0.16$).

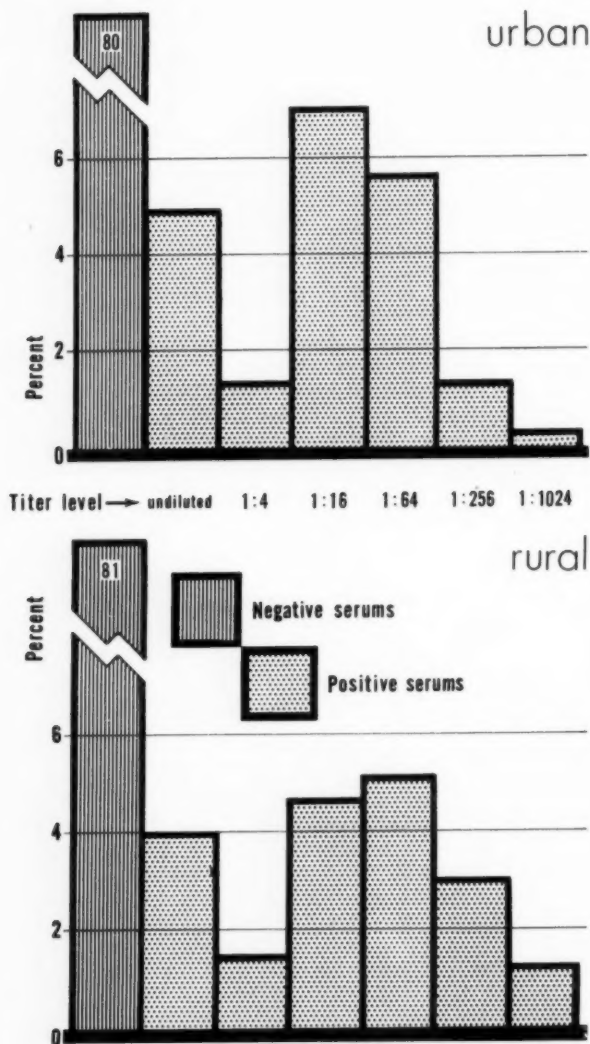
Both the urban and the rural populations showed a distinct bimodal distribution of titers, with an unexpectedly large number of serums positive at the undiluted level. This distribution is illustrated graphically for all ages combined in figure 3. The large number of undiluted positives is consistent with the hypothesis of a nonspecific reaction, but we do not know what significance, if any, these low titers have in the epidemiology of toxoplasmosis.

The upper modal titer for the urban popula-

tion falls at a dilution of 1:16, while the upper modal titer for the rural group is 1:64. This shift cannot be related to age, since both groups include persons from 11 through 19 years, and analysis of the individual age samples does not reveal any trend in this direction. To determine whether the shift of modal titer actually is significant, we tested the data by the chi-square method. For this purpose, the positive serums were divided into two groups, those positive at a dilution of 1:16 or lower and those positive at a dilution of 1:64 or higher. The probability value derived from this calculation is slightly more than 0.05, suggesting that the shift in modal titer between the urban and the rural group may not be significant.

An entirely different picture is obtained, however, when we group together those serums having titers of 1:256 or higher as opposed to those positive at a dilution of 1:64 or lower. With this grouping, the probability value is only 0.009, indicating that the difference between the

Figure 3. Distribution of all serums tested, by titer, showing bimodality and shift of upper modal titer.



two populations is of considerable significance. Thus the rural population shows a strong tendency to produce high titers, but we do not know what the significance or cause of this tendency may be.

For both sexes and all ages combined, 20.4 ± 1.6 percent of the 627 serums tested from the urban group were positive (all titers), as compared with 18.9 ± 1.9 percent of the 445 serums from the rural group. Somewhat lower rates are obtained when only titers of 1:16 or higher are considered positive, on the assumption that the lower titers may represent nonspecific reactions in accordance with the bimodal distribu-

tion of titers which we previously mentioned. The rates in this case are 14.2 ± 1.4 percent for the urban sample and 13.7 ± 1.6 for the rural group. But whether we consider all titers or only those of 1:16 or higher, the numerical difference between the urban and rural rates is small, and statistical analysis verifies that it is merely a reflection of sampling variation. The probability values are 0.48 for all titers and 0.76 for titers of 1:16 or higher. Thus it is clear that there is no significant difference in prevalence of antibodies between the urban and rural populations of our study.

Conclusions

The examination of serums from comparable urban and rural Negro populations in Tennessee has shown that the two groups are essentially the same with respect to the prevalence and titer distribution of antitoxoplasmic antibodies. If we accept the presence of these antibodies as an indication of previous infection with *T. gondii*, then we must conclude that, at least insofar as the populations which we studied are concerned, persons living in urban or rural environments have an equal chance of becoming infected with this parasite. (For a discussion of the specificity of these antibodies, see reference 1.) From the epidemiological standpoint, this means that for an explanation of the transmission of this infection we probably must look not to factors associated primarily with one environment or the other but rather to factors common to both. Elucidation of these factors should be the goal of future research in this field.

Summary

With the Sabin-Feldman dye test, 627 serums from an urban Negro population and 445 serums from a comparable rural population were tested for antitoxoplasmic antibodies. All persons tested were 11 to 19 years old.

Analysis of the results with respect to the prevalence and distribution of titers showed that there is no difference between the sexes at any age; that the titers have a bimodal distribution in both the urban and rural groups, with an abnormally large number of undiluted

positive serums; that, although there is a difference in the upper modal titer between the two groups, it probably is not significant; that the rural group shows an unexplained tendency to produce titers of 1:256 or higher; and that the prevalence of positive titers is essentially similar in the urban and rural populations, both when all titers are considered together and when only titers of 1:16 or higher are considered.

The similarity between the urban and rural populations suggests that the factors responsible for transmission of human toxoplasmosis are common to both environments rather than being peculiar to one or the other.

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Dental Manpower Resources

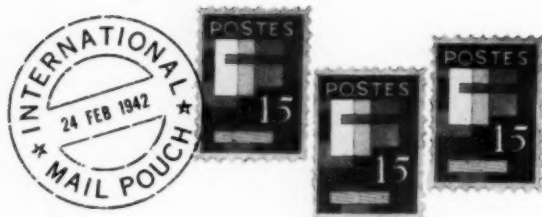
The demand for dental care is expected to increase more rapidly than the number of practicing dentists and dental hygienists in 11 western States.

Of the 95,000 dentists who are expected to be practicing in the United States by 1975, about 16,000 will be located in the west. This would be an increase of 4,000 over the number practicing in the region during 1955, but still it would be 5,000 short of the number needed to maintain supply at the current level. It will be roughly 20,000 under the number required to meet the higher per capita demands for care which are expected at the end of the 20-year period.

Currently, western schools are graduating only 400 dentists annually. To meet demand, they must graduate an average of 1,600 a year between 1960 and 1975.

Dental hygienists must also be trained in greater numbers. Additional training programs are needed in junior and 4-year colleges. The west needs approximately 800 dental hygiene graduates a year, compared with the fewer than 70 now being supplied.

These requirements are stated in "Dental Manpower Requirements in the West," a survey covering Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The survey was undertaken at the request of the Western Interstate Commission for Higher Education and was conducted by the Division of Dental Resources, Public Health Service, in cooperation with the American Dental Association and the W. K. Kellogg Foundation.



These paragraphs, based on overseas reports from public health personnel with missions and field parties of the International Cooperation Administration, give a glimpse into health work abroad. The original material appears in an administrative publication distributed by the Public Health Division of the ICA.

First Movie

An Arabic language moving picture on sanitation shown for the first time in a Jordan village attracted an audience exclusively of men and boys. In Jordan villages it is not the custom for women to appear at public gatherings in male company. Rather than give up the time needed for a duplicate showing for the women, a sanitarian persuaded the villagers to separate the women and girls from the men and boys by an open aisle. This device permitted the women and girls to see their first movie; it was in fact the first movie for anyone in the village.

—ARTHUR L. DOPMEYER, *acting chief, Cooperative Department for Health and Sanitation, United States Operations Mission, Jordan.*

Latrines for Pilgrims

Yumbel (population 5,000), seat of the shrine of San Sebastian in Chile, receives as many as 50,000 pilgrims on the peak day of the festival and 80,000 during the week. They arrive on foot, horseback, in oxcarts, autos, trucks, special trains, and even in boxcars. For the first time in the history of the festival, health officials provided latrines for the visitors: 45 prefabricated structures placed in groups around the plaza and walled off to facilitate traffic control and cleaning several times a day. A fee of 5 pesos was charged, if user was able to

pay. Although free service was not denied, 50,000 pesos were collected. The church will pay for the installation cost (280,000 pesos) with funds collected from the pilgrims. It is planned to install 15 more latrines at other points next year. A 10,000 liter tank, a deep well, and chlorinator were installed to supplement the town's usual water supply. The visitors were impressed with the latrines and inquired about means of obtaining them for installation elsewhere.

—PHILIP L. RILEY, *acting chief, Division of Health and Sanitation, United States Operations Mission, Chile.*

Population Gain

For the first time in the recorded history of Orchid Island, 50 miles off the southeast coast of Taiwan, there seems to be a gain in population as a consequence of DDT spraying for malaria control. Only 1 out of 12 on the island is over 45 years old. The island has no roads, no footpaths more than 18 inches wide. There isn't a wheel to be seen. The children fish. The women grow taros. The older men watch the children. The men wear only a closely tailored fig leaf. The women seem to cover themselves where they happen to be cold.

—JAMES P. WARD, M.D., M.P.H., *chief public health officer, International Cooperation Administration Mutual Security Mission to Taiwan.*

Hard Going

Heavy floods, deep mud, and washed out bridges forced two physicians to abandon their jeep en route to the Okinawan Colony on the Rio Palmetillas in Bolivia. They crossed two swollen rivers and 5 kilometers of mud on foot to visit the colonists who were preparing to receive about 160 Okinawan immigrants. The colony kindly supplied horses for the return trip. At that point, the physical condition of the villagers was better than that of the doctors.

—GEORGE ADAMS, M.D., M.P.H., *chief, Health and Sanitation Division, United States Operations Mission, Bolivia.*

Available methods for isolating, identifying, and tracing to their sources of origin the organic chemicals polluting our water supply are reviewed.

Organic Contaminants Affecting the Quality of Water

By F. M. MIDDLETON, B.S., M.P.H., and A. A. ROSEN, Ph.D.

TODAY'S vast chemical industry and particularly its giant offspring, the production of synthetic organic chemicals, have introduced new problems to scientists engaged in providing and protecting the Nation's supply of pure water. By one route or another, these chemicals or the waste products resulting from their manufacture enter the natural environment and affect the water adversely not only for the householder but even for further industrial use. Many of the products, particularly the synthetics, were unheard of a few years ago. Recent and estimated production rates of several of these chemicals are shown in table 1 (1, 2).

Industrial contamination of water, while important, is not the only factor to consider in the complex organic pollution situation. Domestic sewage, natural run-off, and materials derived from the life cycle of aquatic plants and animals contribute substantial quantities of organic materials to streams. Increased supplies of phosphorus and nitrogen from sewage

and other sources may stimulate extensive growth of algae or other aquatic life. Artificial water impoundments also may promote the growth of objectionable organisms.

The complexities of disposal of wastes from the production of organic chemicals have been described by Hess and Carney (3). The residues from large diversified manufacturing processes may contain thousands of complex compounds including byproducts, process aids, unreacted raw materials, and the manufactured product itself. The volume of these wastes may be as large as that of the main product. Effective treatment methods for many of these complex materials remain to be developed. Even when practical and economical treatment has been devised, complete elimination may be impossible.

Effects on Water Supplies

The effects of the diverse mixtures of organic materials on each other, on water, and on the consumer of drinking water are only beginning to be appraised. Among those known are the production of taste and odor in water and interference with treatment of water for industrial and domestic use. Costly ion exchangers deteriorate under the attack of organic chemicals in water (4). Acids are suspected. Polynuclear hydrocarbons possessing carcinogenic

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Table 1. Recent and estimated production of certain synthetic organic chemicals, in millions of pounds

Year	Detergents	Plastics	DDT	Organic agricultural chemicals	
				Benzene hexachloride	Toxaphene, chlordane, aldrin, and dieldrin
1947			560	8	
1950	1,660	2,280		75	40
1952			105	160	115
1955	2,000	3,500	125	170	
1960	2,500	4,800	155	200	
1975	4,000	9,000	200	225	

characteristics were detected by Wedgewood (5, 6) in waste effluents of domestic and industrial origin. An extensive review of the literature on the toxicity of materials known to be discharged into water has been initiated (7).

Taste and odor in drinking water, the most obvious contaminating effect of organic chemicals, is a widespread problem of considerable significance and causes more consumer distress than any other factor in water plant operation. In a 5-year period (1948-52) chemical costs for the control of tastes and odors at the South District Filtration Plant in Chicago (8) amounted to \$462,000, equivalent to 21.7 percent of the total chemical cost. More than 1,000 water plants in the United States use active carbon for the control of taste and odor. While carbon treatment and other methods for controlling these objectionable conditions have been developed, difficulties are frequently such that the required treatment cannot be provided.

An indirect effect on health arises when unpalatable water causes the consumer to seek other drinking water sources—even bacterially contaminated ones.

Isolation and Identification

The organic chemicals occurring in water are usually present in very low concentrations, but a few parts per billion (p.p.b.) of contaminants may produce significant taste and odor. One part per billion is equivalent to a teaspoonful of material in 1 million gallons of water.

The low concentrations, complexities, and

varieties of organic pollution in water make the recovery and identification of these substances difficult. Specific methods, with few exceptions, for the analysis of the multitude of organic chemicals in water are lacking. Furthermore, ordinary analytical techniques are usually inapplicable to the extremely low concentrations which must be studied. Some means of concentrating the materials for analysis is necessary. Methods for concentrating, isolating, and identifying these materials have been under study by the Public Health Service at the Robert A. Taft Sanitary Engineering Center. Exploiting the unique adsorptive properties of active carbon, a filter has been developed which adsorbs most organic material from water. After water or wastes in quantities from 100 to several thousand gallons pass through the filter, the carbon is dried and the organic materials are extracted with chloroform or other organic solvent in a Soxhlet extractor.

The organic substances recovered from the carbon differ with the type of solvent used for the extraction. Chloroform, the solvent used in most studies, has been found to recover those substances principally responsible for undesirable taste and odor in water. Alcohol will remove a quantity of material equal to or greater than the amount recovered by the chloroform even after preliminary extraction by chloroform. These highly water-soluble materials recovered by alcohol appear to have relatively little significance as taste and odor factors. Most materials investigated for their taste and odor effects are adsorbed quantitatively by carbon, but desorption by chloroform is only 65 to 80 percent complete. Following extraction, the solvent is removed by distillation, and the residue is subjected to further analysis. Liquid-liquid extraction methods also have been utilized for concentration of materials from some effluents.

Details of the use of the carbon filter (fig. 1) and certain applications, particularly to taste and odor studies, have been described (9, 10).

Raw and Finished Water Studies

Raw and finished waters have been sampled by means of the carbon filter in several locations and under various conditions of pollution.



Figure 1. Bank of carbon filters used for collecting small concentrations of organic materials from water. Several thousand gallons of water are passed through these filters which adsorb organic contaminants from the water. The recovered materials are then analyzed for chemical content.

Table 2 lists the concentrations of organic materials recovered by chloroform extraction of the carbon. These materials are frequently sticky, brown semisolids having strong disagreeable odors resembling paint or varnish. Some of the samples show distinct oil layers.

It is significant that the organic materials survive standard water treatment processes and in many instances appear in the finished water in concentrations equal to those found in the raw water.

Little information is gained from the com-

Table 2. Recovery of organic materials from various waters by the carbon filter method

Location	Number of samples	Water source	Sample source	Type of pollution	Recovery of organic materials (parts per billion)		
					Maximum	Minimum	Average
Cincinnati, Ohio---	38	Ohio River-----	Finished water---	Sewage and industrial waste.	630	79	220
Nitro, W. Va.-----	14	Kanawha River--	Raw water-----	Chemical waste---	3,060	170	930
Columbus, Ohio---	3	Scioto River-----	do-----	None-----	82	38	62
Piketon, Ohio-----	2	do-----	do-----	Sewage and industrial waste.	606	587	597
Wyandotte, Mich--	4	Detroit River---	Finished water---	Industrial waste and sewage.	336	38	203
Saginaw, Mich----	1	Lake Huron-----	do-----	None-----			25

plex residue without further chemical separation. Utilizing solubility differences, the materials are separated into the broad groups of water-solubles, acids, bases, neutrals, and phenolic materials. The distribution by groups of the chemicals recovered from various waters is shown in table 3.

The neutral materials, whether the pollutants are of industrial or natural origin, generally constitute the most abundant group. Since neutral substances are less reactive than other classes of compounds, they can be expected to resist biological and chemical attack to a greater degree. However, even hydrocarbons that are quite stable chemically may be attacked biologically. Neutral compounds which may occur in water are aliphatic and aromatic hydrocarbons and their halogen derivatives, alcohols, aldehydes, ketones, ethers, esters, nitro compounds, amides, nitriles, sulfides, and many others. The neutral substances are frequently sources of intense odor which can be detected when only a few parts per billion are present.

Hydrocarbons and Related Materials

Aliphatic and aromatic hydrocarbons have been consistently isolated from drinking waters obtained from sources in the vicinity of petroleum refinery waste outfalls. These materials survive water treatment processes in concentrations sufficient to cause serious impacts on taste and odor. Associated with these materials are sulfur compounds, probably cyclic sulfides, also responsible for odor in water. A study of taste and odor components in refinery effluents and a method for identifying petroleum wastes in surface waters have been published (11, 12).

As much as 1 p.p.m. of organic material was recovered in the drinking water of a city located 10 miles below an area containing a concentration of chemical industries. Materials found include substituted benzene compounds, kerosene, polycyclic hydrocarbons, and phenyl ether. Intense odor was a pronounced characteristic of the recovered materials. The phenyl ether recovered was detectable by odor tests at a concentration of 5 p.p.b.; the pure laboratory reagent at 13 p.p.b.

Phenolic compounds have long been recog-

nized as being detrimental to water quality, particularly from the standpoint of taste and odor. These compounds are associated with waste products from coke plants, oil refineries, and other industries. The taste and odor intensity of many phenolic substances is increased several hundredfold when reacted with the low concentrations of chlorine ordinarily used at the water treatment plant. A 1 p.p.b. concentration of the chlorinated materials may be detectable by taste and odor. However, phenolic pollution is more amenable to control at the water plant than other types of pollution.

Petrochemical wastes have presented problems recently. No standard definition of the term "petrochemical" is available but the book "Petroleum Processing" suggests:

PETROCHEMICAL, n.: A chemical compound or element recovered from petroleum or natural gas or derived in whole or part from petroleum or natural gas hydrocarbons, and intended for chemical markets.

Included in this group are such familiar chemicals as alcohols, benzene, ammonia, carbon black, acetone, aniline, styrene, and sulfur. Wastes from the manufacture of these materials are complex and highly odorous. Where wastes are discarded into streams without adequate treatment, outbreaks of intense taste and odor have occurred. On one occasion, under winter conditions, the taste and odor were reported to have traveled 1,000 miles. The waste materials responsible were recovered from drinking water 400 miles from the point of discharge and were partially identified.

The development of the petrochemical industry has come about almost entirely since 1940. It is estimated that, at present, there are over 300 petrochemical plants (13) in operation in this country. In 1954, this industry produced 27 billion pounds of petrochemicals comprising approximately 25 percent of the total chemical production.

The rate of expansion of petrochemical production indicates that in 1965 this industry will be the source of half the chemicals produced in the United States. The extensive uses of petrochemicals derived from crude oil and natural gas cracking are summarized in the inset (p. 1130).

Nitriles have been isolated from drinking

Table 3. Chemical groups separated from carbon filter extracts of water samples taken from seven sources

Chemical group	Source, location, and type of water sample						
	Scioto River, Columbus, Ohio (tap)	Scioto River, Piketon, Ohio (raw)	Ohio River, Cincinnati, Ohio (tap)	Lake St. Clair, Mount Clemens, Mich. (raw)	Lake Michigan, Waukegan, Ill. (raw)	Big Sandy River, Catlettsburg, Ky. (raw)	Activated sludge sewage treatment plant, Richmond, Ind. (effluent)
Ether insoluble			6.2				
Water soluble		10.2	24.3	2.2	15.4	8.6	
Amine	5.5	2.4	3.2	1.6	4.3	2.4	8.6
Weak acid	12.1	6.2	16.7	17.2	20.4	14.0	30.0
Strong acid	12.1	11.3	14.0	13.0	7.9	13.4	21.8
Neutral	70.5	69.9	37.2	66.0	53.0	62.0	39.4

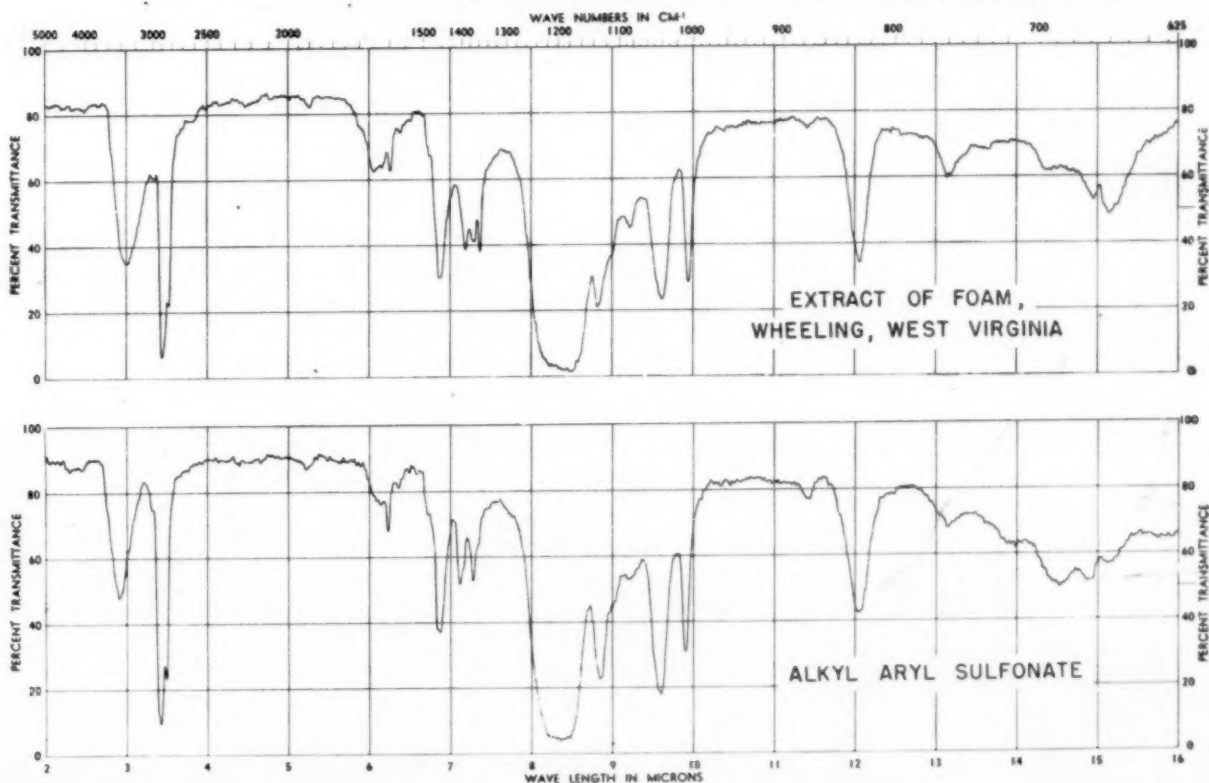
water in an area well known for the manufacture of petrochemicals. Acrylonitrile was indicated to be a component by infrared tests. While the toxicity of these organic cyanogen compounds is not great compared to the alkali cyanides, their presence in drinking water merits further study. Alcohols, aldehydes,

ketones, acids, and esters have been found in various waters. Some of these appear to be of industrial origin while others may be naturally produced.

Insecticides

Concentrations of DDT in the range of 1 to 5 p.p.b. were found in the drinking water of sev-

Figure 2. The similarity of these infrared spectra indicate that foam material from the raw water at Wheeling, W. Va., contained large amounts of anionic synthetic detergents.



eral cities using rivers as sources of supply. The insecticide could not be recovered at all times but persisted for a 6-month period in one location. The major source of the DDT was presumed to be spray operations.

Through the widespread agricultural use of

DDT, exposure resulting from various sources (14, 15), particularly food, is much higher than the exposure that could result from ingesting drinking water containing a 5 p.p.b. concentration, the estimated maximum level found in the waters examined. Although present levels of

Basic Petrochemicals and End Products

CRACKING

OXIDATION

OTHER CHEMICAL TREATMENT

of crude oil and natural gas

give methane ethane propane butane ethylene acetylene
butadiene naphtha butylene propylene cyclopentadiene
isoprene isobutylene benzene cyclohexane

which **synthetic fibers**
acetates acrylics polyesters
nylons vinyls

are **synthetic rubbers**
butyl GR-S types neoprene
nitrile polyurethane types

used **plastics, resins**
alkyds epoxys phenolics polyesters
to polyethylene styrenes vinyls

make **automotive chemicals**
antifreezes hydraulic fluids oil additives
tetraethyl lead fluid other gasoline additives

also these other important end products

alcohols detergents drugs explosives glycerin ketones
miscellaneous solvents nitrogen fertilizers pesticides
plasticizers protective coatings refrigerants rocket fuels

Source: The Chemical Industry Facts Book, 2d Ed., Manufacturing Chemists Assoc., Inc.

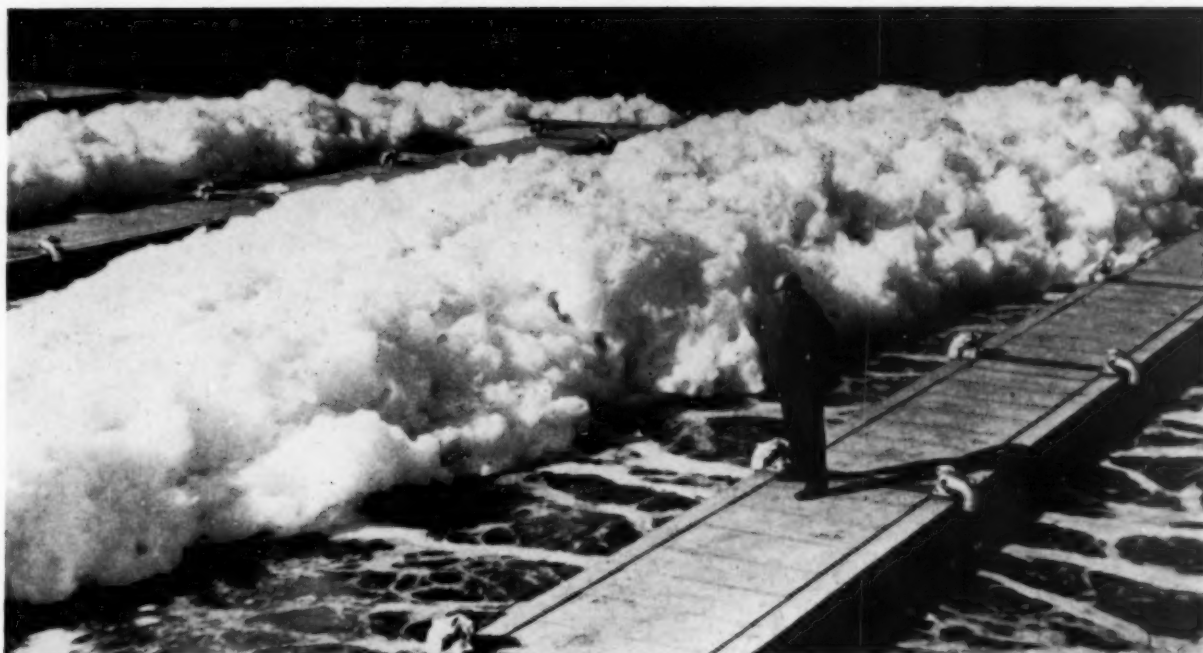


Figure 3. Picture of frothing conditions of sewage plant at Benton Harbor, Mich. The exact causes of this foaming condition are not known but synthetic detergents have been implicated. Analysis has shown large quantities of detergents in the foam.

such materials as DDT in water may not be significant from the standpoint of human physiological effects, concentrations below 1 p.p.m. of chlorinated insecticides are toxic to fish (16); toxaphene (17) has been reported to be lethal to fish in 10 days at less than 6 p.p.b. concentration.

Synthetic Detergents

Synthetic detergents as potential water polluting materials are receiving much more attention since the occurrence of excessive foaming at water plants in Kansas and West Virginia (18, 19). These materials are unique in that virtually all of the product ends up as waste. A review of the detergent problem has been published (20). Foam materials from Wheeling, W. Va., were identified by means of infrared spectrums as originating from synthetic detergents of the alkylarylsulfonate type (anionic). (Approximately 80 percent of all detergent produced is of this type.) The striking resemblance of the infrared spectrums of the pure material and materials recovered from the foam (fig. 2) leaves no doubt as to the presence of surfactant in the foam. Tastes, odors, and interference with water treatment

have been ascribed to the presence of these materials in concentrations of a few parts per million. This concentration does not normally occur in water. These substances are resistant to biological forces of purification in the stream and will survive usual water treatment processes although they are readily adsorbed by active carbon. Small concentrations have been isolated from tap water, and the materials undoubtedly constitute a portion of our daily organic intake with drinking water.

Sewage treatment plants have experienced troublesome foam problems. Foaming may be due to causes other than detergents, but in a number of instances high concentrations of anionic materials have been present in the foam materials. Samples of the foam from the Benton Harbor, Mich., plant (fig. 3) were shown by infrared methods to be high in detergent materials. A report (21) has described the difficulties of the frothing at this plant.

Natural Materials

Products of natural origin in water are frequently responsible for taste and odor difficulties. In addition, kills of wild and domestic

animals have been associated with blooms of certain toxic algae. Odors of these materials are often described as musty, earthy, pigpen, geranium, fishy, and cucumber. Many of these odors have been associated with algae. Silvey (22, 23) has proposed that actinomycetes are responsible for musty and other odors in various waters, particularly in the southwest. The chemicals elaborated by the organisms have not been identified. A musty component has been recovered from numerous waters in the Cincinnati laboratory by extended purification following steam distillation of the neutral materials. This material constitutes a very small percentage of the total extract but possesses an extremely intense odor.

Waters from various surface sources have contained substantial quantities of carbonyl compounds. Such materials as organic acids, ketones, and aldehydes may result from natural decay, oxidation, and life and death processes of plants and other aquatic life. Organic acids may also represent an intermediate step in the oxidation of industrial materials, including hydrocarbons. Hence identification of these materials does not reveal their origin.

Much remains to be learned of all the effects natural products have on the pollution of our water resources. One objective of studies in progress at the Robert A. Taft Sanitary Engineering Center is the determination of the role of algae as sources of taste and odor. Further chemical studies are being pursued in areas experiencing difficulties in taste and odor where nonindustrially polluted waters serve as a source of supply.

Summary

Water quality is seriously affected by contamination from organic materials. Both drinking water and industrial supplies are impaired. Apart from the nuisance and deprivation caused by effects on drinking water, it is conceivable that physiological effects may result from high concentrations of these materials in public water supplies. At what concentration materials such as those isolated from drinking water constitute a hazard is not known. Many of the organic materials in water have not yet been isolated or identified.

Methods for studying these materials have been indicated and some of the results outlined. In view of the increased industrialization, increased water use, and the present lack of knowledge of natural pollutants, the total effects of organic chemicals on water quality and means for the control of the materials demand increased attention.

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technical publications

The Dentist in the U. S. Public Health Service

PHS Publication No. 475. 20 pages; illustrated. 15 cents.

Opportunities for dental officers in the commissioned corps of the Public Health Service are shown in this booklet. It outlines the admission requirements for the Regular and Reserve Corps and describes the integration of dental research, clinical dental practice, and dental public health within the Service.

Basic, clinical, and applied research are conducted, respectively, at the National Institute of Dental Research, the Clinical Center of the National Institutes of Health, and the Division of Dental Resources.

Dentists are assigned to treat merchant seamen, Coast Guardsmen, Indians, and other eligible groups at Service hospitals and outpatient clinics.

Preventive measures which can be widely applied are the responsibility of the Division of Dental Public Health. Here dental officers develop

or improve methods of preventing or controlling dental diseases. They may also be assigned to provide consultation and assistance to States and communities endeavoring to improve dental health.

Clinical Memoranda on Economic Poisons

PHS publication (unnumbered). 1956. 78 pages. Multilithed.

The Technical Development Laboratories of the Communicable Disease Center has issued its annual revision of the material on economic poisons (see *Public Health Reports*, September 1955, p. 836).

The book is divided into five sections: organic phosphorus insecticides, chlorinated hydrocarbon insecticides, solvents, rodenticides, and miscellaneous compounds.

Each section gives general information applicable to the group of compounds under consideration, and

each memorandum gives information on the identity, formulations, and uses of a poison. Toxicology of the poison with specific reference to human cases, its dangerous dose to man, laboratory findings, and treatment are discussed.

Appendixes A-E give instructions for collecting and shipping of samples for the analysis of pesticides or determination of their physiological effects.

Copies are available from the Communicable Disease Center, Public Health Service, Atlanta, Ga.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

A Survey of Tobacco Smoking Patterns in the United States

As a supplement to the United States Bureau of the Census Current Population Survey for February 1955, smoking histories were collected from approximately 40,000 men and women 18 years of age and over. Persons in the survey were a representative cross section of the population of the United States. The questionnaire regarding smoking history was similar to that used by the American Cancer Society and the National Cancer Institute in their forward studies on the association of smoking and lung cancer. The questions covered the use of cigarettes, cigars, and pipe tobacco, attempted to distinguish between occasional and regular smokers, and included items on age at which smoking was started and the maximum consumption rate ever attained. The census information on age, sex, residence, race, and other population characteristics was made available for analysis.

The survey objective was to classify the population by broad smoking categories, and no attempt was made to validate verbal statements on rate of use by diaries or other records of consumption or purchases. Current cigarette consumption as estimated from the survey data was checked against the national aggregate consumption determined from tax data, which indicated that the survey underestimated cigarette consumption by approximately 15 percent. Considering the different intent for which the questions on smoking were designed, the correspondence between the survey and tax estimate seems good.

Of the 49.6 million men and 55.1 million women 18 years of age and over in the civilian population outside institutions, 11 million men (23 percent) and 37 million women (67 per-

cent) are reported to be nonsmokers, that is, they had never smoked tobacco occasionally or regularly in any form. Of the remaining 38



Public Health MONOGRAPH

No. 45

The accompanying summary covers the principal findings presented in Public Health Monograph No. 45, published concurrently with this issue of Public Health Reports. Mr. Haenszel and Dr. Shimkin are with the National Cancer Institute, National Institutes of Health, Public Health Service, Bethesda, Md., and Mr. Miller is with the U. S. Bureau of the Census.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

Haenszel, William, Shimkin, Michael B., and Miller, Herman P.: Tobacco smoking patterns in the United States. Public Health Monograph No. 45 (Public Health Service Publication No. 463). 111 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956.

million men with a history of tobacco use, 31 million had smoked cigarettes regularly at some time during their lives. The corresponding numbers of lifetime male cigar and pipe smokers were 4.8 and 7.9 million, respectively. The numbers of current regular male smokers were as follows: cigarettes, 26 million; cigars, 2.8 million; pipes, 3.9 million. Of the 18 million women who reported some use of tobacco, 15 million had at one time or another been regular cigarette smokers. Thirteen million were regular smokers at the time of the survey. All of these estimates have been adjusted to take account of persons in the sample for whom no smoking histories were obtained.

Cigarettes are the major form of tobacco used. Trade sources estimate the number of cigarette smokers at about 60 million, and this figure probably includes "discontinued" smokers. If one adjusts the survey results to include occasional smokers, persons in military service and in institutions, and smokers presently under 18 years of age, the maximum resulting estimate of cigarette users to be derived from the survey is about 55 million. Some of this discrepancy between the survey estimate and that of trade sources may be traced to different estimates of the proportion of women smokers.

The profiles of age and sex differentials in tobacco use resulting from comparisons based on current practices or lifetime history of use are very similar, particularly for cigarettes. The highest percentage of current regular cigarette smokers appears at 25-34 years of age among both males and females and tapers off in successively older groups. The sex differentials in the proportion of smokers (or nonsmokers) is greatest at ages over 65. Among men over 65 years of age, pipe smoking rivals cigarette smoking in popularity. The differential in favor of cigarettes widens at the younger ages. Moreover, in the younger cohorts there seems to be a shift to "pure" cigarette smoking, accompanied by a lessened tendency to take up cigars or pipe exclusively.

A shift to an earlier age for starting to smoke is observed for younger persons. This has accompanied the rising proportion of regular smokers in these younger age groups. The smoking habit characteristics of a cohort become evident by a rather early age, around

age 18 to 20 for men and at a slightly older age for women. Much of the decline in the number of cigar and pipe smokers may be traced to a failure of these forms of smoking to attract converts at an early age among persons born since 1900.

Aside from differences associated with age and sex, urban-rural residence is the population characteristic which differentiates smoking habits most sharply. Rural nonfarm persons closely resemble urban dwellers in smoking habits, and the sharp demarcation appears between the rural nonfarm and rural farm populations. The farm and nonfarm populations acquire the smoking habit at virtually the same age as the urban population. Among men, the urban-rural differences are emphasized when comparison is restricted to cigarette smokers using more than one pack of cigarettes daily. Cigarette smoking has been increasingly accepted by urban women born after 1890. Sizable acceptance among farm women was delayed almost one generation, to women born after 1920.

Practically no differences in smoking patterns according to size of urban community were noted. This finding is at variance with earlier surveys and suggests that the events of the past 20 years have disposed of community size as an important determinant in shaping smoking habits.

For men, there is little variation in the distribution of smoking patterns in the four major regions of the country (Northeast, North Central, South, and West). The proportion of female nonsmokers is lower in the northeastern and western regions than elsewhere. A higher proportion of heavy cigarette smokers was noted among northeastern males and the excess cannot be accounted for solely by greater urbanization of that area.

The differences between whites and nonwhites with respect to the proportions of nonsmokers and of all regular cigarette smokers are trivial. However, the proportion of white male cigarette smokers who use more than one pack of cigarettes daily is almost double the proportion among the nonwhite males. A similar excess occurs among white females. Urban-rural gradients provide another distinction. Among white males, the rural nonfarm data on tobacco use resemble those for the urban population.

Among nonwhites, the reverse is true, the non-farm data resembling those for the farm population.

Smoking is less prevalent among farmers than among other male occupational groups. Among nonfarm workers, professional and technical personnel had the highest proportion of non-smokers. There is evidence of some ordering by social class, the white-collar groups having more nonsmokers than craftsmen or operatives. This ordering by social class, noticeable for non-smokers and for all regular cigarette smokers, tends to disappear when comparison is limited to smoking more than one pack of cigarettes daily.

The survey data support the observation that military life encourages the adoption of the smoking habit. The greater use of tobacco among soldiers persists after they leave military service.

The results by marital status point to a small deficit of smokers among single persons of both sexes. The proportion of nonsmokers among divorced persons of each sex is lower than for the remainder of the population.

Proportionately more men than women were reported as discontinued smokers at the time of the survey. When sex differences in the number of smokers and length of exposure to the habit are taken into account, the difference

between men and women with respect to discontinuance disappears. For cigarettes particularly, discontinuance rates fall into consistent age patterns and show some stability over a variety of population groups, although in examining the data by population subgroups, a rather general inverse relationship between the proportion of regular smokers and the discontinuance rate does appear. It does not appear necessary to qualify group comparisons, based either on maximum or current rate of smoking, by taking into account the effect of discontinuance on duration of exposure to the habit.

The major purpose in collecting smoking histories was to investigate the meaning of the reported associations between smoking and lung cancer and to check whether the distribution of lung cancer deaths is consistent with estimates of the excess risk among smokers and the distribution of smokers in the population. The application of the data to test proposed models for lung cancer etiology was reported in the *Journal of the National Cancer Institute*, June 1956. This report is devoted solely to presentation of the census findings, and it is hoped that these data may prove useful to persons interested in the social, economic, and marketing aspects of tobacco use, as well as to investigators interested in lung cancer.

Correction

In table 2, page 654, July 1956 (Effect of Fluoridated Public Water Supplies on Dental Caries Prevalence, by F. A. Arnold, H. T. Dean, P. Jay, and J. W. Knutson), the def rate for 7-year-olds in 1950 should read 4.72, and the def rate for 11-year-olds in 1953 should read 1.09, both in Grand Rapids, Mich.; in table 3, page 655, the DMF rate for 6-year-olds in Grand Rapids in 1953 should read 0.19.

The Nationwide Fight Against Blindness

By FRANKLIN M. FOOTE, M.D., Dr.P.H.

TO ATTEMPT to envisage the estimate of 334,000 blind persons in the United States, imagine a city as big as Miami, Fla., or Omaha, Nebr.—a city in which every man, woman, and child is blind. It is further estimated that more than 27,000 persons lose their sight each year and that, unless our preventive efforts can be made more effective, three-fourths of a million persons now living will become blind before they die. The cost of caring for the blind—education, braille and talking books, seeing-eye dogs, lighthouses, pensions, and other of the inadequate services we try to provide—amounts, according to the American Foundation for the Blind, to \$150 million each year.

Fortunately, there has been considerable progress in preventing blindness. Infectious causes of blindness show a great drop. When the National Society for the Prevention of Blindness was established in 1908 by Miss Louisa Lee Schuyler and Dr. F. Park Lewis, almost one-third of the children in schools

for the blind were there because of ophthalmia of the newborn. The crusading spirit that brought about legislation in every State requiring the use of prophylactic drops in the eyes of every newborn child, coupled with antibiotic treatment of those rare cases which now occur, has brought this cause of blindness to the vanishing point. Health education plus sulfa treatment have almost wiped out trachoma in this country. Although smallpox is responsible for 10 to 20 percent of blindness in some countries which have not had the benefits of the advancing medical sciences, it is virtually unknown here. In only 20 years there has been a reduction of 60 percent in syphilis as a cause of blindness among children in schools for the blind because many States have enacted wise legislation requiring blood tests before marriage and early in pregnancy. Health education and effective treatment of infected patients also have reduced the effects of syphilis.

Even eye injuries as a cause of blindness among children in schools for the blind show a significant decrease: 40 percent in the past 20 years. This decline can perhaps be attributed in part to sound legislation such as that controlling sale of the more dangerous kinds of fireworks and controlling use of air guns, in part to health education of young parents by public health nurses and social workers, and in part to improved methods of therapy.

Retrolental fibroplasia as a cause of blindness has come to play an all too prominent role. It is estimated that there now are 8,000 children blind from this one cause. For years, the National Society for the Prevention of Blindness has been interested in promoting research on this problem. The organization established

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a committee in 1951 which finally led to a coordinated attack on blindness, participated in by 18 hospitals and 75 investigators and sponsored by the Public Health Service's Institute of Neurological Diseases and Blindness, the National Foundation for Eye Research, and other agencies as well as the society.

Although the entire story of the mechanism of how oxygen leads to retrolental fibroplasia and how oxygen can be given when necessary without producing blindness has yet to be elucidated, steps already taken to avoid excessive administration of oxygen to premature infants have virtually eliminated this cause of blindness from many hospitals. In the State of New York, 18 newborn infants were reported to the Commission for the Blind in 1954 as being blind from this disease in that year. In 1955 this figure had dropped to 3. The national society has contributed more than \$40,000 in grants-in-aid for research in retrolental fibroplasia.

The discussion thus far—ophthalmia of the newborn, syphilis, injuries, and retrolental fibroplasia—has provided examples of primary prevention, action to prevent blindness even before the cause begins to operate.

Impact of the Later Years

Despite the progress that has been made, there is reason to believe that the actual number of the blind in the United States is increasing. This increase is in part produced by our increases in population. In part it also reflects the advances made in the past 50 years which have added 20 years to the average span of life—from 48 in 1900 to 69.6 at present. Today, many more persons live to an age when glaucoma, cataracts, and other eye diseases are more frequent and when such diseases as diabetes and arteriosclerosis produce loss of sight.

The chronic eye diseases of middle and later life constitute a much greater problem than those discussed earlier. Many of them cannot be cured in the light of our present knowledge, and the best we can hope to do for some of these conditions, such as glaucoma, is to retard them. This kind of prevention of disability is coming to be known as secondary prevention: The disease is clearly present, but something can be done through early detection and

optimum treatment to prevent or at least to lessen the extent of disability. In some instances, such as cataracts, retinal detachment, and corneal disease, surgery often restores sight if performed at the proper time.

Much of the prevention of blindness in the past has been accomplished by influencing relatively small numbers of people. For example, boards of education can require vaccination against smallpox before a child enters school; then their staffs will see to it that every child is vaccinated. Boards of health or State legislatures can require the use of prophylactic drops in babies' eyes immediately after birth, and proper enforcement procedures will make sure that this is done. Hospitals can require adequate control of oxygen if it is prescribed for a premature infant, and we should have little or no more retrolental fibroplasia.

But there seems to be no easy procedure that we can direct people to follow to prevent blindness from most of the eye conditions of middle and later life. The patient with a detached retina needs early and competent care if the required surgery is to be successful. The patient with acute uveitis, with glaucoma, with many other conditions, needs early care and needs to follow the oculist's instructions to the letter if he hopes to avoid loss of sight. The patient with a detached retina must get into the proper hands, accept the diagnosis, and be willing to have an operation promptly.

This means that we are discussing individual, highly personal problems. It means that we must somehow influence in the right way every one of the 167,000,000 persons in the United States if we are to make progress in combating blindness from these causes.

The average person, in my opinion, does not like to go to a doctor, even when he has serious eye symptoms. Even though he is frightened by the idea of blindness, he has a good deal of inertia and hopes that somehow his eye trouble will go away by itself, the way it came. He did not ask for his symptoms and cannot understand why he should be bothered by them. I think he would far rather buy a new television set than pay for an eye examination, and if, by some chance, the eye examination reveals nothing wrong, he feels cheated. If a serious eye disease such as glaucoma is diagnosed, he may

react as did 69 percent of the eye patients in a recent study made by a California oculist (1). Since they never before had heard of the disease, how could they understand its implications? Many persons may believe that eyedrops advertised in a bus, new eyeglasses, or even proper illumination are all that is needed to treat or avert what you and I know to be serious conditions.

Need for Continuous Education

In 1951, Owens, Cox, and Hochreiter (2) reported on 100 blind persons in the Baltimore area in an attempt to determine why they had lost their sight. For approximately half the patients, they found that either there was no effective care or treatment available or, if available, that everything possible had been done at the right time, without avail.

For the other half, it was felt that blindness could have been prevented but was not for various reasons. For 31 out of 50, the reason was attributed to the patient: lack of knowledge of early symptoms of eye disease and the importance of seeking and carrying out competent ophthalmological advice. In some cases where the patient sought advice from the family doctor or some other practitioner, referral to an ophthalmologist was not made for many months or even years. A few of the preventable cases of blindness were from accidents.

Medical societies and departments of public health are doing much to inform the public on health matters in general, but their efforts in so specialized a field as blindness prevention need reinforcement. Therefore, a voluntary citizens' agency, such as the national society, in which both professional and informed lay persons are joined in partnership, can make a significant contribution in bringing about a more informed public. If he is one of those who has been informed, an eye patient will be more likely to cooperate in the plan of treatment outlined when told of the diagnosis and the regimen to be followed.

The Mass Media

Our public education program has become more effective since we have given it full-time

attention. The month of September 1955 was again proclaimed "Sight Saving Month" by 30 State governors and by many mayors. Because the national Advertising Council approved this intensive campaign, it is estimated that more than a million dollars' worth of radio and television time was devoted to messages about care of the eyes. Science reporters and magazine writers in increasing numbers are coming to our headquarters for suggestions and to verify their data. During the past 3 years several magazines which reach millions of persons have carried well-written and scientifically sound articles on eye problems, whereas less than 20 years ago no such story had ever appeared in the mass media. Although misleading articles and those apparently designed for self-promotion are published occasionally, the careful checking being done by many magazines and newspapers indicates vast improvement in the reliability of the material they use.

Aside from the mass media of communication, the national society works with all professional groups that are or should be interested in sight conservation. For instance, some of our information efforts are directed toward keeping the general medical practitioner and the pediatrician up to date on advances in ophthalmology.

Local Programs

One of our departments works with teachers colleges and State and local departments of education to keep the million school teachers of our country alert to eye health problems. To improve vision screening programs for school and preschool children, the national society has helped to support important research on vision testing, and our nurse consultant works with public health nurses and volunteer groups.

The value of medical social service activities has been clearly demonstrated in such centers as the eye and ear infirmaries of Massachusetts and of Illinois. Our staff medical social work consultant seeks to improve the provision of followup for eye clinic patients and those needy persons being served in State and local welfare programs.

Because we have not yet arrived at that millennium when all persons have chosen an eye

doctor and go to him periodically for an eye checkup, it seems well to encourage experimentation with screening programs for adults as well as for children. Among adults, it is evident that a screening test for visual acuity, ophthalmoscopic examination, taking the tension with a tonometer, and possibly using the Harrington multiple-pattern test of field of vision will discover about one person in 50 over the age of 40 years with glaucoma (3-5). Where such surveys have been conducted, at least one result has been that everyone concerned has learned what glaucoma is and what value there is in early diagnosis and continued treatments.

In vision screening activities, participated in by the national society in various States, an important byproduct has been the education of volunteers assisting in the programs. In the course of their training, hundreds of volunteers have become informed about such eye topics as the need for early care of children with strabismus. They have learned that there is no such thing as a "minor" symptom of eye trouble and that what might appear to be a relatively trivial symptom, such as slight blurring of vision or difficulty in reading the newspaper, may be the only early warning sign one will have of so dangerous an eye disease as glaucoma. Nearly all these volunteers are women, and their new-found knowledge finds its way to club meetings, coffee parties, and bridge games. A well-trained volunteer may help to pass on information to 5 or 10 other adults.

Safety Glasses in Industry

It is estimated that 300,000 eye accidents still occur each year in industry, in vocational shops, and at home. Our objective in industry is to promote not only eye safety but also improved screening programs which will help to reveal otherwise unrecognized eye disease. Eye safety is being aided by an incentive program known as the Wise Owl Club, which originated in St. Louis in 1947. Admission to this exclusive club is won by a worker if his eyesight has been saved by the conscientious wearing of safety glasses at the time a work accident occurs.

The occasion of an award dramatizes the fact that a man's vision has been saved, a fact that

otherwise might pass unnoticed. We now have records on nearly 10,000 Wise Owl members who have had the sight of at least one eye saved by wearing safety glasses. More than one-fourth of this group saved the sight of both eyes. This is an impressive number of men and women who would be blind but for the preventive measures that have been accepted.

Need for Research

The Baltimore study by Owens showed that about half of the blindness now occurring could not have been prevented no matter what was done. The need for both fundamental and clinical research in the blinding eye diseases is therefore obvious. The support that the national society has given to some projects in this field has already been indicated. We have also tried to stimulate the interest of various foundations in the field of eye research, and at various times have presented information on the need for ophthalmic research to congressional committees. In the early days of the national society, it had become apparent that there was need for data on the extent of blindness, on the relative importance of various causes, and on their incidence by sex, age groupings, race, and geographic factors. When the material produced by our statistical division (6) was presented to a congressional committee in a fact sheet in June 1949, Committee Chairman Percy Priest called it "very helpful."

It has already been noted that blindness is costing us at least \$150 million each year. In contrast, the American people are allocating not more than \$3 million, or possibly 2 percent of this amount, to eye research and to organized programs for prevention. One might ask whether we can afford to put more into prevention and into research. The answer lies in our sense of values, indicated by retail sales of nonprescribed eye lotions and eye washes in the amount of \$4,910,000, and mascara, eyebrow pencil, and eye shadow to the sum of \$7,180,000 (7). And, of course, billions more are spent on commodities and services which are far less valuable than the protection of human eyesight.

In quoting these figures I do not wish to imply that anyone should be deprived of what en-

hances or adds pleasure to life. In view of what America is willing to spend on products of such ephemeral value, though, this Nation will certainly appreciate the greater and more lasting value of research and prevention. If we can stimulate such research and apply present and future knowledge to the prevention of blindness, our progress will exceed even the impressive advances already achieved.

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Air Pollution Demonstration Projects

A grants-in-aid program for demonstration projects related to air pollution and its control has been established by the Public Health Service. These projects are for the purpose of evaluating or demonstrating the effectiveness of various methods of preventing and combating various air pollution problems.

State and local government air pollution control agencies and other public agencies may apply for grants-in-aid for air pollution demonstration projects at any time.

Applications will be reviewed on the basis of the relative need for such a project; the adequacy of facilities and skills available; the characteristics of the air pollution problem in the area; how the results will apply to other parts of the country; and how much the applicant can contribute to the total cost of the project.

Grants for demonstration projects will be for a specific amount paid in a lump-sum to the grantee for 1 year. They may be renewed for two additional periods of 1 year each, depending on the availability of Federal aid. Demonstration project activities must begin within 6 months after the grant is approved and must be used only for the specific project.

Information about these grants may be obtained from any of the Regional Offices of the Public Health Service or from the Chief, Division of General Health Services, Bureau of State Services, Public Health Service, Washington 25, D. C.

Speed Zone Epidemiology: A Preliminary Report On Benzathine Penicillin G For Gonorrhea in Women

By CARL E. HOOKINGS, M.D., D.P.H.,
and L. M. GRAVES, M.D.

SINCE the discovery by Neisser of the role of the gonococcus in gonorrheal infections, efforts have been made to prevent the spread of this organism from one person to another. With the advent of penicillin in 1944, it was hoped that gonorrhea would be rapidly controlled, but this hope has not been realized. Since there has never been any difficulty in effecting cures in men no matter what type of penicillin has been used, one is led to believe that the reason for continued high rates is that infection in women is either undetected, inadequately treated, or both.

The Venereal Disease Control Clinic in the Memphis and Shelby County Health Department on March 16, 1953, set up a "speed zone" epidemiology program. In speed zone epidemiology all male patients are interviewed for the names of contacts and an effort is made to bring these contacts to examination and treatment within 72 hours.

The results of this program have been disappointing. Between March 16, 1953, and March 16, 1956, 9,835 men were admitted to the clinic. They named as contacts 15,410 women, of whom 12,921 were within the jurisdiction of the health department. Of these 12,921 women, 83.5 percent have been brought to examination and

treated either as infected patients or as possibly incubating contacts. In the first year of the "speed zone" epidemiology program, 3,229 men with gonorrhea reported to the clinic; in the second year, 3,397; in the third year, 3,209. The contact index remained at the 1.5 level over the 3 years. We have felt that our failure to reduce the incidence of gonorrhea has been due to our inability to control the disease in women.

Should a woman have sexual intercourse with a man within 24 hours following her treatment, it is conceivable that he may contract gonorrhea and, though he name her as the contact, she may be found to be free of the disease. Such an infection has nothing to do with the adequacy of therapy; at the time of contact the penicillin had not yet killed the gonococci. Apparently the sex activity of certain patients is such that the therapeutic agent does not have the opportunity to act long enough to prevent the woman from contracting the infection herself or from giving the residual infection to her partner.

The present study was undertaken to determine whether therapy has been adequate and whether other therapy might be more effective. Therapy had consisted of 600,000 units of procaine penicillin with aluminum monostearate (PAM) to each female patient plus the advice to take vinegar douches and to refrain from sexual intercourse and indulgence in alcohol for at least a week. Abstinence from alcohol was intended to increase resistance to infection and to sexual impulses. We decided to determine whether the addition of 1.2 million units of benzathine penicillin G (Bicillin) with a consequent longer lasting blood level of penicillin would improve the female patient's chance of bacteriological cure and reduce the incidence of repeat visits by female contacts. (Benzathine penicillin G was supplied by Wyeth Laboratories under the trade name Bicillin.)

During this study, 150 women, named as contacts, were admitted to the Memphis and Shelby County Health Department Clinic and cervical and urethral smears were taken. All of these women were given 600,000 units of PAM and 1.2 million units of benzathine penicillin G and

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advised to douche and refrain from sexual intercourse for at least a week. They were asked to return in 1 week and again in 4 weeks when re-examination and repeat smears were taken. Any patients whose smears were positive were re-treated with the same schedule as before.

Results

On pretreatment examination, 122 of the original 150 women in the study were found to have a smear positive for gram negative intracellular diplococci from either cervix or urethra, or both. Of these 122 women, 85 (70 percent) were treated. They returned to the clinic as directed for two followup examinations. Smears taken at these examinations were negative for the diplococcus. Thirty-four women failed to return, while three who completed the followup were found to be positive for the diplococcus. Of the original 150 women in the study, 28 had negative smears on initial examination and smears continued to be negative throughout the 30 days during which they were under observation. Of the original 150 women, 10 were renamed as contacts to men suffering with gonorrhea during the study period, and examination of these women showed 4 to be positive and 6 negative for gonorrhea.

In a study undertaken February through June 1955, it was ascertained that 15 percent of all female contacts were renamed by men with a diagnosis of gonorrhea during a period of 60 days following initial identification of the women as contacts. A similar study conducted February through March 1956, after the introduction of benzathine penicillin G for the treatment of gonorrhea in women, showed that 6.7 percent of contacts named (10 in 150) were renamed. This is a significant reduction, and we feel it is due entirely to the change in therapy.

There has also been a reduction in the number of men entering the clinic and diagnosed as having gonorrhea during the period January 1-May 25, 1956. The accompanying table shows this reduction to be the first of any magnitude since accurate records were kept, beginning March 16, 1953. It is true that this reduction has occurred only for a very short period but we have reason to believe, because

of the downward incidence of gonorrhea week by week until the day of the writing of this paper, that it will continue.

Gonorrheal infections in males treated in Memphis and Shelby County Health Department, January 1954-May 1956

Month	1954	1955	1956
January.....	230	295	¹ 215
February.....	227	224	210
March.....	265	303	266
April.....	223	202	² 193
May.....	274	246	209
Subtotal (5 months)....	1, 219	1, 270	1, 083
June.....	348	370	-----
July.....	275	280	-----
August.....	319	339	-----
September.....	329	377	-----
October.....	240	217	-----
November.....	218	187	-----
December.....	261	251	-----
Total (12 months)....	3, 209	3, 291	-----

¹ Beginning January 1, 1956, female contacts were treated with 600,000 units PAM and 1.2 million units Bicillin.

² Beginning April 1, 1956, males were treated with 600,000 units PAM and 1.2 million units Bicillin.

The addition of long-acting penicillin in the treatment of gonorrhea seems to have started a reduction in incidence of the disease in the venereal disease clinic of the Memphis and Shelby County Health Department. It is believed, however, that without the "speed zone" epidemiology technique a change in therapy alone would be ineffective. It is equally obvious that this technique alone over a 3-year period has in itself been equally ineffective. A combination of the two is necessary for success in the reduction of the incidence of gonorrheal infection in the community.

Conclusions

Speed zone epidemiology in itself is not adequate to control gonorrhea.

The addition of a long-acting antibiotic reduces the number of women reinfected and renamed as contacts within 60 days.

The addition of a long-acting antibiotic as a therapeutic agent reduces the incidence of gonorrhea in men.

Report on Barbiturates

CURRENTLY there is a clamor and outcry in the press about the widespread misuse of barbiturates with reports of accidental deaths and demands that these drugs be placed under strict control. This is not a new complaint. It was in response to just such a note of alarm that 13 years ago the Committee on Public Health of The New York Academy of Medicine first deliberated on the value of barbiturates, the dangers of their misuse, and proper measures for their control. Two years later it formulated a code that set the pattern of control, a pattern that has been widely adopted. Now a rising chorus of protest over the existing situation has prompted the committee to reexamine the problem of barbiturates.

Definition

The barbiturates comprise a family of many chemical compounds of which barbituric acid is the parent. Some 53 years ago one of the derivatives was introduced into therapy under the name of veronal. Since then by substitution of an aliphatic or aromatic group, barbituric acid has yielded a large number of derivatives. Many have proved to be therapeutically useful.

Each of these has a chemical name; in addition, it has either a popular name or a registered trade name. Since barbiturates are members of a series, all have essentially the same pharmacological and therapeutic action, but each shows an individuality. Hence, there are preparations containing two or more barbiturate derivatives; each such mixture is usually marketed under a registered proprietary name. Furthermore, pharmaceutical manufacturers have added a small amount of barbiturates to mixed preparations in which they are not the main ingredient. It is said that the number of products containing barbiturates, including single, multiple, and mixed ingredients, now exceeds 275.

Use of Barbiturates

The therapeutic uses of the barbiturates are several: hypnotic, sedative, anticonvulsant, anesthetic, and adjuvant with analgesics. Thus, one or more of these substances is the active principle in sleeping pills and in some of the tension-reducing preparations. They are, however, not to be confused with the newer so-called tranquilizing drugs such as rauwolfia or chlorpromazine. (Some of the newer tranquilizing drugs

which are growing in popularity as substitutes for the barbiturates may have similar hazardous effects. They have not been considered in this report because their use is as yet too brief to warrant an authoritative statement.) The barbiturates are also an almost indispensable therapeutic agent for the control of convulsions in epilepsy. Each drug in the barbiturate group is marketed and dispensed as an individual preparation; some are included in multi-ingredient prescriptions and products. As a group the barbiturates are rated among the 10 most valuable drugs available to physicians.

Their value is reflected in the extent of their use. In view of their properties it is perhaps not too surprising that the production and sale figures are very high. The total national production of barbiturates has shown a steady increase since World War II. In addition to their increased use as hypnotics, it is believed that pharmaceutical manufacturers more and more are incorporating small sedative doses of barbiturates in mixed preparations. Ideström states that in the United States in 1948 the estimated consumption was 336 tons or 24 doses of 0.10 gm. per person as compared with an estimated consumption in 1952 in Sweden of 20 tons or 29 doses of 0.10 gm. per person.

From a study in 1954, Fazekas and Koppanyi assert that between 3 and 4 billion doses of barbiturates are legally prescribed by the medical profession in the United States annually. Assistant Commissioner Trichter of the New York City Health Department estimates that 12 percent of all prescriptions compounded by pharmacists in this city contain one or another of the barbiturates. They are also dispensed

In view of the national interest in commerce in barbiturates, Public Health Reports reprints from the June 1956 Bulletin of The New York Academy of Medicine the report of its Committee on Public Health. The report was prepared by the Subcommittee on Barbiturates: Haven Emerson, M.D., chairman, Henry Aranow, Jr., M.D., George Baehr, M.D., McKen Cattell, M.D., Hubert S. Howe, M.D., Lawrence C. Kolb, M.D., Robert W. Laidlaw, M.D., J. Murray Steele, M.D., H. D. Kruse, M.D., secretary. It was approved by Edward J. Donovan, M.D., president of the academy.

on prescription on a large scale in England and Wales as was revealed by two analyses. Dunlop and associates examined 17,301 prescriptions covering the month of September 1949 and found that 1,636 or 9.4 percent were for barbiturates. In an analysis made by the Ministry of Health of 106,295 prescriptions issued during October 1954, 8.8 percent were for barbiturates or preparations containing barbiturates. The percentage of all prescriptions in which barbiturates were the sole or principal agent in 1954 was 6.4 percent. It is apparent that these highly useful drugs are widely used.

Misuse of Barbiturates

In any consideration of misuse it is necessary at the outset to examine assertions concerning their allegedly promiscuous use. Parenthetically, it should be stated that consideration of promiscuous use at this point is restricted to usage of barbiturates at their usual hypnotic or sedative level; usage of them in excessive doses will be considered separately. By promiscuous use is meant their unrestricted, indiscriminate use when they are unnecessary, ill-advised, or contraindicated. It carries the connotation of misuse.

The allegation concerning barbiturates is twofold. It has been charged that the public is obtaining barbiturates illegally and taking them without advice of a physician; and that some physicians are prescribing barbiturates irresponsibly. The argument is based in part upon the increasing annual production of barbiturates and the calculated per capita consumption of them. Taken alone this is scarcely a reliable argument. For an increase in consumption is not necessarily *prima facie* evidence of misuse. It has already been noted that pharmaceutical manufacturers increasingly have incorporated small sedative doses of barbiturates in mixed preparations.

As for the allegation against physicians, it is the opinion of Fazekas and Koppanyi that the great volume and proportion of legally prescribed barbiturate preparations are mainly responsible for the widespread belief

that barbiturates are used promiscuously in therapeutics. From their study on whether barbiturates were being promiscuously prescribed, they concluded that physicians were using barbiturates for disturbed states because there was no specific or an equally good therapeutic product available. In the opinion of these investigators, the physicians were using the barbiturates rationally and with full knowledge of the limitations; and they were waiting only for the advancement of medical science to provide an effective therapeutic alternative or preferably replacement. Fazekas and Koppanyi predicted that if physicians had "at their disposal truly etiotropic drugs for anxiety and tension states, they would certainly not prescribe barbiturates."

The wide prevalence of psychiatric complaints among the population must add up to a large volume of legitimate therapeutic need. In applying the proper rationale to meet this need physicians have little latitude of choice. Prescriptions of barbiturates to meet this need would not *per se* be promiscuous. Rather, it would be a discharge of inescapable responsibility with the most effective therapy available.

Categories of Misuse

Like many things of value, barbiturates are undoubtedly misused. When there is use in excessive amounts and overdosage or in conjunction with alcohol, that indubitably is misuse. This misuse falls into five categories according to attendant circumstances.

The first type of misuse is prolonged use of barbiturates in slightly excessive amounts. Some individuals may be of such unstable personality as to rely upon barbiturates to enable them to face the real or fancied tension of their daily lives. Thus, because barbiturates afford relief from anxiety, tension, and conflicts, they lend themselves to habitual self-medication at a slightly increased dosage, particularly in disturbed states for which there is no specific therapy.

Second, barbiturates may be misused as a substitute for narcotics or

alcohol. Narcotic addicts who are temporarily unable to obtain the narcotic of their choice may turn to barbiturates. Alcoholics may resort to barbiturates to relieve the tremor and nervousness following a drinking episode. Another variety of misuse in this category is the ingestion of barbiturates following drinking of alcohol; or vice versa. Large doses of barbiturates may be taken inadvertently during a period of alcoholic intoxication. Then too, some individuals deliberately combine alcohol and barbiturates to obtain a brief but intense exhilaration, which is of course followed by profound intoxication and narcosis. This is a highly dangerous practice; for, as pharmacologists have repeatedly warned, these drugs in combination have a potentiating action which magnifies the effects of each.

The remaining three categories have to do with episodes of overdosage of barbiturates which occur either accidentally or intentionally. A person who wants only to obtain rest during a period of extreme stress may take an excessive amount of a barbiturate. Usually he is seeking a quick and full effect; he wants to make sure that he will fall into a deep sleep without delay. Perhaps he subscribes to the old adage that if a little is good, a lot is better. At the same time he is unfamiliar with the dangers of barbiturates. As a result he may increase the dosage and consume a quantity far in excess of that required to produce a night's sleep.

More frequently an unintentional overdose occurs because a person ingests additional doses after failure of the usual hypnotic dose to produce sleep. After a person takes one or two sleeping pills, he may enter into a twilight zone of mental confusion and forgetfulness instead of dropping off to sleep. In this state he forgets that he has already taken the pills; he takes more. Thus, he accidentally ingests excessive amounts of barbiturate while he is in a semi-stuporous state induced by the original dose. This sequence is known as automatism.

In addition to these episodes of overdosage which are purely ac-

cidental or inadvertent, in others the intent is suicide. Hence, barbiturates are misused as a means of self-destruction. Indeed, they are a popular choice. Yet judged by their relative effectiveness, it is a less perfect choice for the purpose than numerous other methods. Nevertheless, it represents the gravest misuse of these valuable drugs.

In sum, whatever the motive and attendant circumstances, persons may increase the amount of barbiturate ingested to the point where an episode of acute poisoning occurs. Not infrequently it terminates fatally.

Effects of Misuse

The effects of misuse of barbiturates may be considered under three headings: habituation and addiction; chronic intoxication; acute poisoning. Because barbiturates afford relief from anxiety, tension and conflicts, they lend themselves to habitual use, especially since there is no specific therapy to supersede them. There is a difference of informed opinion as to whether they should be termed addicting or habituating drugs. It may be helpful to consider a definition of terms.

To most laymen the word "addiction" simply means a bad habit. To experts it means more than that, but they differ on its definition. According to pharmacologists the significant element in addiction is dependence, either physical or emotional. Tatum and Seevers have defined addiction as "a condition developed through the effects of repeated actions of a drug such that its use becomes necessary and cessation of its action causes mental or physical disturbances." However, Isbell and Fraser do not regard this definition as acceptable to physicians and social workers who have to handle addicts. They state that the concern about addiction is "not because individuals who use drugs become dependent but because the effects of the drug are harmful both to the individual and society." This view is reflected in Vogel, Isbell, and Chapman's definition of drug addiction "as a state in which a person has lost the power of self control with reference to a

drug and abuses the drug to such an extent that the person or society is harmed."

In their review of the subject, Isbell and Fraser state that the Drug Addiction Committee of the National Research Council reached a definition of drug addiction which represents a compromise between a formulation based on dependence and that based on harm to the individual or society. It is: "Addiction is a state of periodic or chronic intoxication, detrimental to the individual and to society, produced by the repeated administration of a drug. Its characteristics are a compulsion to continue taking the drug and to increase the dose with the development of psychic and, sometimes, physical dependence on the drug's effects. Finally, the development of means to continue the administration of the drug becomes an important motive in the addict's existence."

Isbell and Fraser then point out that physical dependence is not an essential part of this definition; and that psychic dependence, although a necessary, is not a specific and distinctive characteristic. In their opinion the latter adds nothing to the definition. They express their preference to return to their original position in defining addiction "as a state of periodic or chronic intoxication in which an individual compulsively abuses a drug to such an extent that the individual or society is harmed."

While agreeing that an addicting drug produces harm to an individual or society, the committee would place emphasis on dependence and, for purposes of differentiation, particularly on physical dependence. Perhaps the best way to understand addiction is to distinguish it from "habituation." "Habituation," so far as the use of drugs is concerned, signifies an emotional dependence resulting from repeated use; administration of the drug may be discontinued without disturbance of bodily functions. In contrast, "addiction" is considered to be an altered condition of the cells, tissues, and organs of the body, brought about by the continuous administration of a drug; cessation of use causes painful physi-

cal as well as mental disturbances. In brief, habituation refers to the condition in which psychological stress appears upon abstinence; while addiction pertains to the condition in which physical signs also occur upon withdrawal.

Vogel, Isbell, and Chapman assert that barbiturates fulfill all three criteria of addiction: development of tolerance, habituation, and physical dependence. They report that when barbiturates are withdrawn abruptly from patients who have been taking 12 gr. or more daily for several weeks, convulsions and acute psychotic reactions appear. From these results they are emphatic in declaring that the derivatives of barbituric acid are addiction-producing drugs since they can bring about not only psychological but also physical dependence. It would appear therefore that physical withdrawal symptoms occur when large amounts of barbiturates have been ingested over a period of time. Under these conditions it is probably accurate to refer to barbiturate addiction.

The Expert Committee of the World Health Organization, after considering the problem, concluded "that the barbiturates must be considered drugs liable to produce addiction, [and] dangerous to public health, although differentiation among them with respect to the intensity of this liability cannot be made at this time."

After weighing all the evidence it is the opinion of the Committee on Public Health that true addiction manifested by physical dependence with withdrawal symptoms may follow prolonged high dosage of barbiturates. But, the committee emphasizes that the symptoms of addiction with barbiturates are produced only under these specific conditions; and that these conditions do not commonly occur.

Of equal if not greater concern is the question relating to potential dangers of prolonged ingestion of barbiturates in small amounts. It may be pointed out that the habitual daily use of small or moderate doses of barbiturates under medical supervision has been continued for many years without evidence of harmful

effects. Only low grade tolerance is developed under such circumstances; therefore the tendency to increase dosage to obtain adequate effects is minimal. This is a sharp point of distinction between barbiturates and opiates. Although psychic dependence on these substances may develop, it is believed not to be injurious. It is like habituation to coffee or tobacco. From these observations it is the belief of the Committee on Public Health that the habitual daily use of barbiturates at therapeutic levels, even for long periods, is not perforce injurious. It should not be necessary to add that this pronouncement does not connote approval of or condone the use of barbiturates for whatever length of time without valid reason and medical supervision.

Like almost every form of medication, barbiturates when misused are capable of producing toxic effects and even death. Through regular, prolonged use of barbiturates in excessive amounts chronic intoxication develops. The symptoms of this toxic cumulative action are mainly mental, psychic, and neurological. Specifically, these manifestations are: muscular incoordination, slurred speech, inability to perform skilled acts, as well as mental symptoms, such as confusion, abnormal behavior, impaired judgment, and possibly hallucinations.

Acute intoxication results from an overdose, either accidental or suicidal, on a single occasion. It may be mild, moderate, or severe in degree depending upon whether the person remains conscious, or becomes semicomatose, or comatose. Mental and neurological disturbances are the principal symptoms. In the severe form unless prompt and energetic therapeutic measures are instituted, the outcome may be fatal. The degree of intoxication and the issue depend on the type of barbiturate, the dosage, and the patient's constitution and physical status.

Prevalence of Misuse

It is difficult to derive accurate figures on the total prevalence of misuse of barbiturates because data in one or more categories are un-

trustworthy or unobtainable. For example, the general public seems to be familiar with the sedative and somnifacient effects of barbiturates; but no one can state reliably how many persons are obtaining barbiturates illegally and taking them in the usual or slightly higher sedative or hypnotic dose without medical supervision. (Where rates are reported, they are based on per million population, total, male, or female.)

Addiction. Reliable data indicating the extent of true addiction, that is, prolonged daily ingestion of very large quantities of barbiturates, are not available. Despite the total quantity of barbiturates used, the figure for addiction is believed to be insignificant; for, addicts are not frequently encountered. Addiction is probably limited to persons who, if the barbiturates were not available, would take excessive quantities of alcohol or other drugs.

Of 919 barbiturate poisonings in New York City in 1954, 36 were said to be in barbiturate addicts.

Poisonings. Due to inadequate report procedures the prevalence of chronic poisoning is not known. Data are therefore exclusively on acute poisonings. These may be conveniently classified under the headings nonfatal and fatal.

Nonfatal poisonings. Not all cases of barbiturate poisoning are fatal. The nonfatal cases may require treatment in a hospital. It is reported that in England and Wales the number of cases requiring hospital treatment has increased in recent years. In the United States about one-fifth of all instances of drug poisoning are due to barbiturates. It is estimated that 1 in every 2,000 admissions to hospitals is for acute barbiturate poisoning.

Figures on the incidence of nonfatal poisonings in New York City since 1945 are available by years. Under article 7, section 86 of the Sanitary Code of New York City it is the duty of persons in charge of hospitals and of physicians to report poisoning, whether acute or chronic, by drugs due to self-medication or on prescription. The nonfatal poisonings are reported to the

bureau of preventable diseases of the New York City Department of Health and from there to the poison center of the department. The rate of total nonfatal poisonings, including both categories, has risen steadily in New York City from 1945 to 1954. Indeed, it has more than doubled over that period. The rate was 35.4 for 1945; it reached 61 in 1948; and became 97 in 1954.

Nonfatal poisonings comprise two categories: poisonings under accidental or undetermined circumstances, and unsuccessful suicidal attempts. Locket and Angus, reviewing 64 consecutive cases entering Oldchurch Hospital in England in the 4 preceding years, found that 49 at least were suicidal attempts. Moreover, of all cases of attempted suicide admitted alive during the 4 years, barbiturates were the chosen agents in more than 80 percent.

Analysis of the rates of nonfatal poisonings in New York City between 1945-54 reveals that unsuccessful suicidal attempts constituted the major category every year, sometimes by a ratio of 2:1. The rate for attempted suicide was 22.4 per million living population in 1945; it became 42 in 1948; it rose to 58 in 1950; it dropped to 37 in 1952; and returned to 57 in 1954. In contrast, the rate for accidental and undetermined nonfatal poisonings did not exceed 20 per million population until 1949; it became 30 in 1953; and 40 in 1954. It is apparent that the rate of total nonfatal poisonings has increased and that unsuccessful suicidal attempts contribute the major portion.

Fatal poisonings—total deaths. The data on deaths from barbiturate poisoning are much more reliable than those on morbidity. Figures are available for England and Wales, the United States, and New York City.

For England and Wales the rate of total deaths from barbiturate poisonings was 1.36 in 1939, and remained between the range of 1.7 to 2 until 1945 when it became 2.5. Thereafter it has increased steadily to become 13 in 1954 (fig. 1). If the 5-year period from 1939-43 is compared with a later period of similar

length, 1950-54, the average rate of fatal poisonings during the latter shows a sixfold increase, 1.8 versus 10.5.

In the United States the rate for total deaths from barbiturate poisoning was 3.23 in 1939, and remained in a range not exceeding 4.3 until 1945 when the rate was 5.7. It reached 7.6 in 1949; thereafter it declined and has remained between 6 and 6.5 from 1951 through 1954 (fig. 2). If the average rates for two 5-year periods are compared, 1939-43 and 1950-54, it is found that the figure for the later period is slightly less than twice as high, 3.6 versus 6.5.

For New York City the rate was 5.7 in 1939; it gradually increased to 9 in 1943; it jumped to 17.7 in 1944; it reached 27.3 in 1950; it declined slightly over the next 3 years; and then rose to 25.9 in 1954 (fig. 3). The average rate for the period 1950-54 was 24.3; it was 3 times

higher than the average rate of 7.4 for the earlier span, 1939-43.

Comparison of the three sources of data reveals that the rate for total deaths from barbiturate poisoning was higher in New York City for every year from 1939 through 1954 than were the rates for either England-Wales or the United States (fig. 4). From 1939 to 1949 the rate for the United States was higher than that for England-Wales. Thereafter the reverse was true. For 1954 the rate for England-Wales was about twice as high as that for the United States. The comparative order of average rates for 1950-54 was: United States 6.5; England and Wales 10.5; New York City 24.3.

For both males and females in England and Wales the rate of fatal poisonings has risen steadily from 1939 through 1954 (fig. 1). Except for one year, the rates for females were slightly higher. The average rates for the period 1949-53 were:

male, 8.1; female, 10.2. Figures on the distribution of fatal poisonings by sex in the United States are available only from 1949 through 1953. During that period the rates for both sexes declined; the rates for females were slightly higher than for males (fig. 2). The average rates were: male, 5.7; female, 7.7.

Until 1944 the rate for fatal poisonings for males in New York City ranged between 6 and 7.7; in 1944 it jumped to 17; in 1950 it reached a high point of 27.7; and declined thereafter to a value of 23 in 1953 (fig. 3). The rate for females was 5.3 in 1939 and increased steadily until it reached 10.7 in 1942; it jumped to 18.4 in 1944; and reached its peak of 31.3 in 1946. For the next 7 years it fluctuated rather narrowly between 20.3 and 23.1 except for the year 1950 when it was 27. Up to 1948 the female rate was higher than the male but thereafter the male has been higher. The average rates for the 5-year period 1949 through 1953 were: male, 24.4; female, 23.2.

Fatal poisonings comprise two categories: death under accidental or undetermined circumstances and suicide.

Death under accidental circumstances. For England and Wales the rate for accidental death from barbiturate poisonings was 0.3 in 1939, and rose gradually to become 4.1 in 1954 (fig. 1). For the United States the rate for fatal barbiturate poisonings under accidental circumstances was 1.5 in 1939; it remained at approximately that level until 1945 when it reached 2.8; its high point was in 1949 with a rate of 3.1. In 1951 it declined and from 1952 to 1954 it was 2.1 (fig. 2).

The trend of rates for New York City over the same period has been highly irregular (fig. 3). The rate for fatal poisonings under accidental circumstances was 2.4 in 1939; it reached three peaks of 10.1, 10, and 12 in 1943, 1950, and 1952 respectively; and then dropped precipitately to 3.1 in 1954. For each of the three census areas the average rate of the period 1939-43 compares with that of 1950-54 as follows: England and Wales, 0.74 to 3.34;

Figure 1. Deaths from barbiturates in England and Wales, 1939-54, rate per million population.

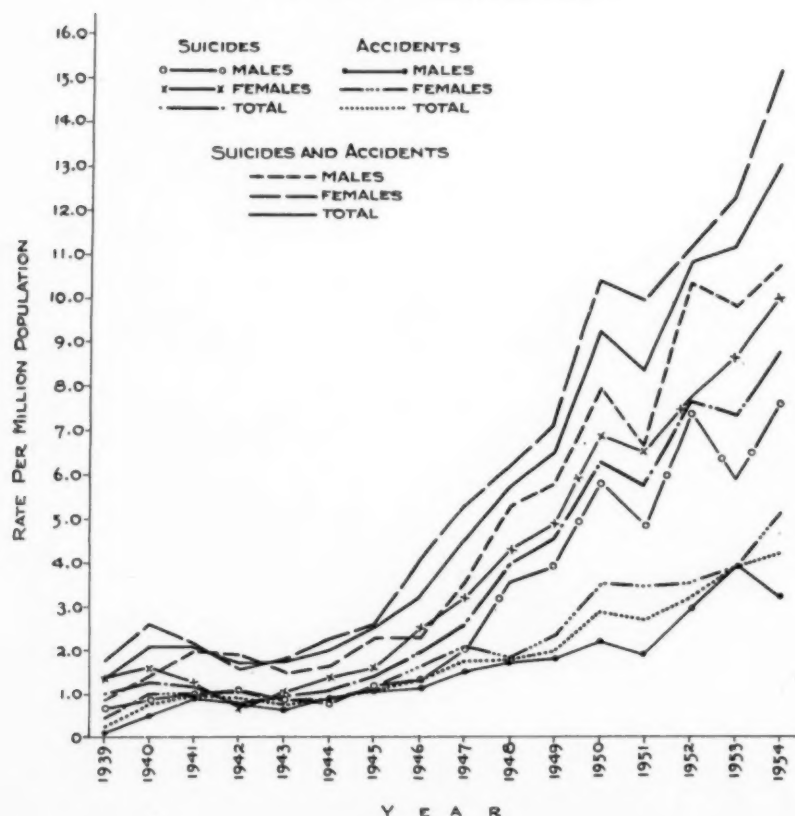
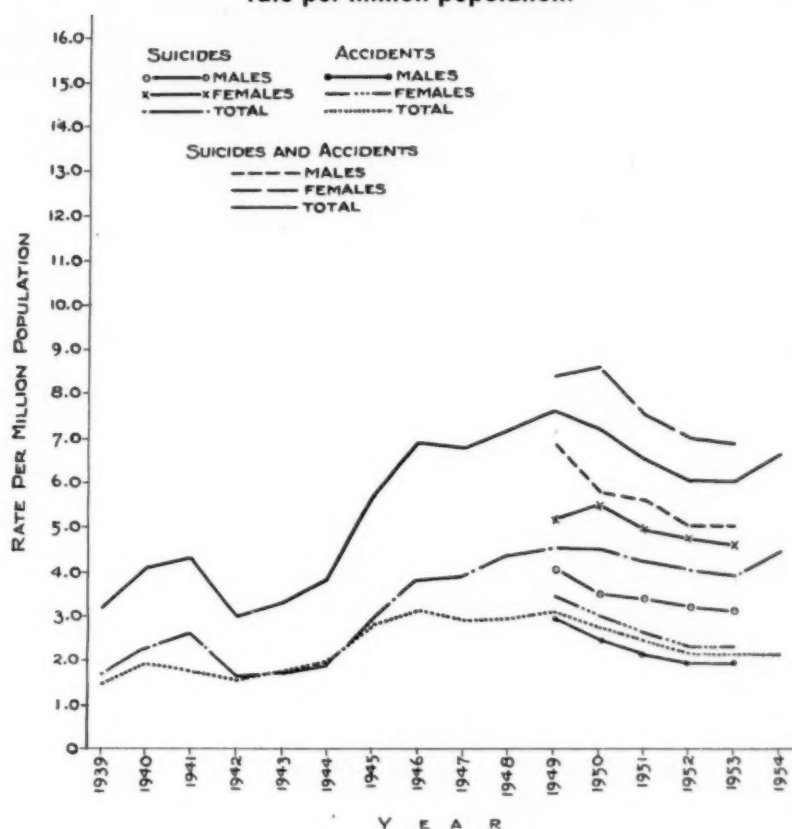


Figure 2. Deaths from barbiturates in the United States, 1939-54, rate per million population.



United States, 1.65 to 2.27; New York City, 3.1 to 8.2. It may be seen that in England and Wales the rate increased almost fivefold; in the United States, $1\frac{1}{2}$ times; and in New York City, $2\frac{1}{2}$ times.

Comparing the three sources of data over the years 1939 through 1954 the rates were highest in New York City (fig. 4). Up to 1950 the rates were higher and thereafter lower for the United States than for England and Wales.

The sex distribution of rates for fatal barbiturate poisoning under accidental circumstances in the data of England and Wales shows a higher figure for females for all except 4 of the 16 years (fig. 1). In 1939 the rate was 0.2 for males, 0.5 for females; in 1954, 3.2 for males and 5.1 for females. The average rates for the period 1949-53 were: male, 2.5; female, 3.3. During that period in the United States the rates for both sexes declined (fig. 2). In 1949 they

were 2.9 for males and 3.4 for females; in 1953 they were 1.9 for males and 2.3 for females.

For New York City from 1939 through 1943, the rate for males fluctuated narrowly between 2.5 and 3; it became 6.6 in 1944, and from 1946 through 1953 it was within the range 7.7 to 9 except for 1950 when it was 11 and 1952 when it was 11.5 (fig. 3). The rate for females from 1939 through 1953 had a general trend upward but it fluctuated with peaks at several points. From 1939 through 1941 it did not exceed 2.9; over the next 3 years it ranged between 4.4 and 5.4; it had peaks of 11.8 in 1946, 9.1 in 1950, and 12.5 in 1952; then dropped to 8.4 in 1953. The male rate was in excess of the female rate for 10 of the 16 years, but the course was irregular. The averages for the period 1949 to 1953 were: male, 9.5; female, 8.6.

From 1918 to 1930 accidental and undetermined fatal poisonings from

morphine exceeded in absolute numbers those from barbiturates. After that period a reversal in the ratio occurred. For example, in 1922 the ratio was 5:1 with morphine predominant. In 1954 the ratio was likewise 5:1 but barbiturates were predominant.

Deaths from suicide by barbiturates. In England-Wales during the period from 1939 through 1954, the suicide rate by all methods tended to fluctuate within a narrow range without showing a definite upward or downward trend. The rate for suicide from barbiturate poisoning, however, after having remained fairly uniform up to 1945, then underwent a rapid rise (fig. 1). Starting at 1 in 1939, the rate became 1.4 in 1945 and reached 8.8 in 1954. If the 5-year period from 1939 through 1943 be compared with a later period of similar length, 1950 through 1954, the average rate of deaths by suicide increased sevenfold, from 1 to 7.1 per million.

In the United States the suicide rate from barbiturate poisoning fluctuated from 1.6 to 2.6 from 1939 to 1944, inclusive; thereafter it rose steadily to reach a level of 4.5 during 1949 and 1950; it declined slightly during the next 3 years and then moved upward to 4.4 in 1954 (fig. 2). The average rate for 1950-54 was double that for 1939-43; 4.2 compared with 2.

In New York City from 1939 through 1943, the rate for suicide by barbiturate poisoning fluctuated narrowly between 3.2 and 5; it jumped to 12 in 1944 and moved rather unevenly to reach 22.8 in 1954 (fig. 3). The average rate for 1950 through 1954 was almost 4 times that for 1939 through 1943; 16.1 as against 4.3 per million.

Upon comparing the three sources of data over the 16-year period 1939 through 1954, the rates are found to be in the following ascending order: the United States, England-Wales, New York City (fig. 4). For the last 5 years of that period the average rate for England-Wales has been 1.7 times that for the United States; that for New York City has been 2.2 times that for England-Wales and 3.8 times that for the

United States. In 1939 Hambourger noted that in the United States the incidence of suicides was nearly twice as high in large cities as in the whole Nation.

The sex distribution on the suicide

rate by barbiturate poisoning for England-Wales shows that for the period 1939-54 the rates for female suicides have with the exception of 1 year been higher than those for the males. The average rates from 1949

through 1953 were: males, 5.6; females, 6.9. Contrastingly, when total suicide rates by all methods are considered, the male rates have been consistently in excess of the female. From 1949 through 1953 in the United States the rates for barbiturate suicides for the females were consistently slightly higher than for the males. The averages were: males, 3.4; females, 5. The distribution by sex of the suicide rate from barbiturate poisoning in New York City from 1939 through 1953 does not show a consistent trend. The averages for the period 1949 to 1953 were: male, 14.9; female, 14.6.

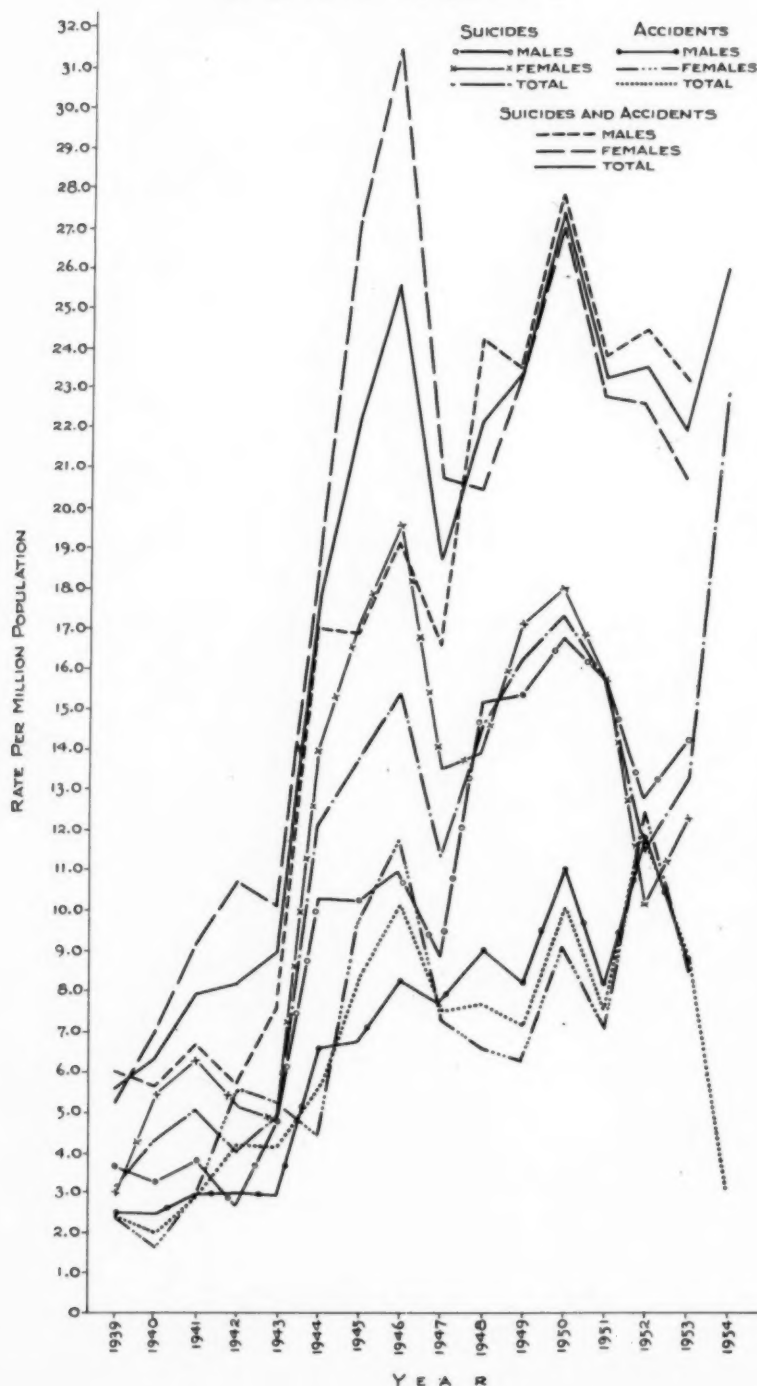
From a study of the England-Wales data Brooke found that the increase in suicide rates from barbiturate poisoning from 1942 to 1954, inclusive, was more pronounced at ages 45 and upwards. In the age group 45-64 the rates for 3 years by sexes were: 1942, males, 1.6, females, 1.5; 1948, males, 7.3, females, 8.6; 1954, males, 14.9, females, 18.1. The rates in the age group 65 and over were: 1942, males, 0.6, females, 0.4; 1948, males, 5.1, females, 6.3; 1954, males, 12.8, females, 24.4. It was remarked that it was in these age groups that one would expect to find most of the cases of depression and insomnia for which barbiturates might be prescribed.

The distribution of the death rate from barbiturate poisoning on the basis of attending circumstances yields striking results. Of the average death rates from barbiturate poisoning during 1950 to 1954, inclusive, in England and Wales, the United States, and New York City, the percentages due to suicide were respectively: 67.6, 64.6, and 66.2. Thus in all three areas suicides account for about two-thirds of the deaths from barbiturate poisoning.

From the England-Wales experience, Brooke commented that a preference has been shown lately for using barbiturates as suicidal agents rather than some other lethal means. This is likewise true in New York City where of recent years barbiturates have become the method of choice for suicide.

Total poisonings, nonfatal and fatal. From the data on total poisonings in New York City, both

Figure 3. Deaths from barbiturates in New York City, 1939-54, rate per million population.



fatal and nonfatal, from 1945 to 1954 inclusive, it is found that the rate was 57.6 in 1945; it increased steadily until it reached 111.1 in 1950; for the next 3 years it was below 100; but in 1954 it reached the peak of 123.3 per million living persons. The rate for 1954 was more than twice that of 1945. Of 491 cases of barbiturate poisoning in

New York City studied by occupation, 40 percent were in housewives, theatrical performers, clerks, unemployed and factory workers with housewives leading all others combined in this group by almost 2 : 1.

The total rate may be separated into two categories: nonfatal and fatal poisonings under accidental and undetermined circumstances; attempted suicide and suicide. It is interesting to examine the composition of this total rate to ascertain the trend and proportion of each component.

Nonfatal and fatal poisonings under accidental circumstances. Barbiturate poisonings under accidental circumstances, both nonfatal and fatal, in New York City have shown an upward trend with some fluctuation over the 10-year period 1945-54. The rate in 1945 was 21.4; in 1954, 43.4. Thus, over this span the rate has more than doubled.

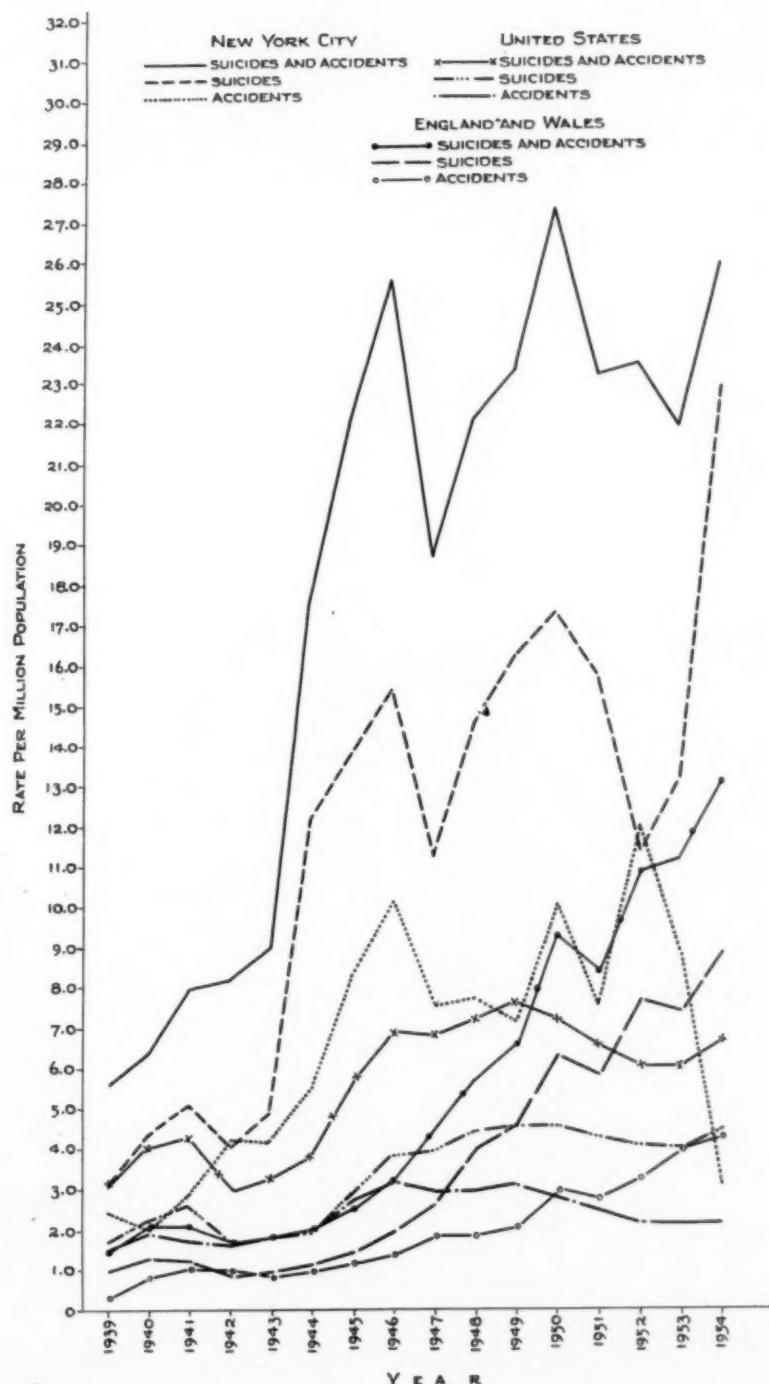
Attempted suicide and suicide. The rate for attempted suicide and suicide from barbiturate poisoning in New York City was 36.2 in 1945; it increased steadily to reach 75.7 in 1950; it declined during the next 2 years; and then resumed its climb to reach 79.8 in 1954. Here again the rate over the 10-year span has more than doubled.

For every year from 1945 through 1954, the rate for combined suicidal attempts and suicide was greater than that for combined nonfatal and fatal poisonings under accidental circumstances. In four of the years the rate was more than twice as high for attempted suicide and suicide than it was for poisonings under accidental circumstances. Over the 5-year period, 1950-54, almost two-thirds of the barbiturate poisonings, both fatal and nonfatal, were by self-destructive intent rather than by accident.

Source of Supply

It is abundantly clear that there has been an increase in the use of barbiturates; it is equally apparent that it has been accompanied by an increase in the misuse of them. But there is sharp difference of opinion over the source of supply which contributed to the misuse. It is con-

Figure 4. Deaths from barbiturates in New York City, United States, and England and Wales, 1939-54, rate per million population.



venient to consider this issue over the source under the headings: misuse of a prescription, and misuse without a prescription.

Misuse of prescription. To be considered under this topic is the charge that many of the prescriptions for barbiturates are unwarranted, ill-advised, or contraindicated. This point has already been discussed under promiscuous use. The extent to which prescriptions include barbiturates was also cited there. It has been pointed out that from such information as is available the physician is prescribing barbiturates justifiably for symptomatic relief in patients who have actual complaints, and that if specific remedies were available he would gladly turn to them.

Sleeplessness and tension are probably the two most frequent complaints for which the physician prescribes barbiturates. Locket and Angus report that in 62 out of 64 cases of barbiturate poisoning, the barbiturate was prescribed for the patient by his medical practitioner; and in more than 90 percent it was given for insomnia either alone or as the major complaint. Certainly such a therapeutic measure by a physician is neither irrational nor unwarranted. On the contrary, the physician is performing his professional duties by the best method available to him.

Another part of the same charge concerning prescriptions for barbiturates is based on their being a source of supply for suicides. Of the 64 patients with barbiturate poisoning reported by Locket and Angus, 49 were suicidal attempts; 9 had made one or more previous attempts. Nineteen were diagnosed as having a severe depressive state; 12 had severe social and domestic disturbances. Some of the patients had previously been in mental hospitals. All had obtained barbiturates by prescription. On studying the source of supply in 718 cases of barbiturate poisoning in New York City, Trichter found 52 percent had obtained the barbiturate on prescription from a physician.

In these instances, critics question whether the prescriptions for bar-

biturates were not ill-advised and contraindicated. The inference is that the physician may have exercised poor judgment and failed to establish adequate precautions. A fair, pertinent, and significant question is: What would have happened to patients who committed suicide by a barbiturate if the physician had not prescribed it? It is not improbable that they would have obtained it from another source or would have chosen another means of self-destruction.

This opens up the entire subject of suicides, not just those from barbiturates. It is beyond the scope of this report to go into that subject in all its ramifications. But for present purposes it should be stated that some patients may give no indication of contemplated self-destruction. Furthermore, when patients issue threats or declare intentions, they seldom utter them in the presence of the physician, and the family either dismisses them or fails to transmit the information. Consequently, all too frequently the physician is not alerted to the possibility of suicide. Moreover, not all persons who issue threats carry them out. Thus it is not easy to reach a decision about the probability of suicide in a patient. Nor is the course of preventive action simple and unobstructed. The patient, or the family, or both, may resist recommendations of supervision and institutionalization. What is virtually demanded is an infallible method of detecting prospective suicides and of thwarting their plans, often without recourse to hospitalization. This, the physician does not have. Yet he must try to bring relief to patients from their complaints. When the situation is viewed in its broad frame, it is at least an open question whether the physician's prescription for a barbiturate to relieve insomnia, anxiety, or tension is ill-advised or contraindicated on the grounds that the patient might commit suicide.

The second type of alleged misuse of prescriptions for barbiturates is the charge that the therapeutic prescription from the physician is very often for amounts beyond the immediate need of the patient. It is probably true that in an attempt to re-

lieve the patient of expenditure of time and money in repeated office visits, the physician may issue prescriptions for barbiturates in excess of the patient's immediate need. Unfortunately, some patients either cannot or will not exercise due judgment in taking the medication as directed; some may save their pills for suicidal purposes. The *Lancet* has reported on two persons who committed suicide, both of whom had been given a fortnight's supply of barbiturates. One had received 72 tablets 10 days before his death, of which only 4 remained. There are no data to indicate the frequency with which physicians prescribe barbiturates in unreasonably generous amounts.

As a third type of misuse of prescriptions it is said that pharmacists and physicians collaborate in dispensing barbiturates indiscriminately but technically in a legal manner. It is asserted that the pharmacists sell barbiturates to persons with no prescription at the time of sale but subsequently the transaction is covered by a collaborating physician who provides a prescription without seeing the patient.

In the fourth type of misuse of prescriptions, the pharmacist is alleged to dispense barbiturates beyond the amount specified in the prescription. Commenting on the seeming unreasonableness of having to return later for an additional supply, the customer asks whether a greater amount than specified in the prescription can be sold. It is conceivable that some pharmacists may yield to accommodating the customer by meeting his request.

At present there are no figures to indicate the number of instances in which these various types of misuse of prescription occur. By some there is said to be flagrant abuse and that it constitutes a considerable source of supply for potential misuse. Others regard this source of supply as negligible.

Without a prescription. In considering source of supply there is another category comprising the various ways in which barbiturates are obtained without a prescription. Three different types of procedure fall under this heading. In the first,

the retail pharmacist is said to dispense barbiturates without a prescription. Where there are legal provisions which require the pharmacist to keep records on the purchase and distribution of barbiturates, these violations are detectable and subject to prosecution. However, the inadequacy of enforcement even in these areas makes the figures on violations extremely unreliable.

The second source of supply without a prescription is from friends and neighbors who usually act from a motive of helpfulness. When a person complains of insomnia or anxiety, a well-intentioned friend with a similar complaint may provide barbiturates out of his supply.

The third source of supply of barbiturates, it is asserted, is illegal traffic with a black market. By some this is regarded to be the major source of supply of barbiturates and responsible for most of the potentialities of misuse. It is alleged to be a vast, gigantic operation. In an article on the subject the *New York World-Telegram and Sun* detailed the four channels which operate outside the usual pharmaceutical routes. First in the illicit trade are export-import firms which obtain their supply from the wholesale druggist. All that the export-import firm needs is a letterhead and a telephone number; for these may be the only credentials on which the wholesaler checks. A second type of illicit operation is by deception and misrepresentation in which supply houses and even pharmaceutical houses are the victims. A person interested in peddling barbiturates at a fantastic profit has a fictitious physician's letterhead or prescription blank printed and on the basis of it places orders with supply houses. The third source of supply which is said to fall into illegal channels is samples for physicians. Reputedly there are 200 different brands of sleeping pills and 1,300 drug houses compound and package one or more preparations. In order to encourage the sales of their products, these companies regularly send samples to physicians. A widespread amount of these products is

said to contribute to the vast illicit traffic.

On the other hand, this image of a vast illegal traffic is not shared by all authorities. Some assert that there is no evidence of production of barbiturates in the United States designed exclusively for illicit sale. They add that although the extent of diversion of barbiturates from legitimate to illegitimate channels is unknown, the infrequency of charges of this practice would lead to the belief that it is comparatively small.

Previous Recommendations

In 1943 in the belief that barbiturates were being sold indiscriminately, the commissioner and deputy commissioner of health of New York City requested the Committee on Public Health to consider the subject and to recommend a solution. At that time the Sanitary Code of New York City included barbiturates among the harmful drugs which could not be dispensed without a written prescription. It further provided that any prescription containing barbiturates should not be renewed or refilled by a pharmacist if it bore any indication to that effect.

The health department was of the opinion that in the indiscriminate use of barbiturates the supply was from two sources: (1) over-the-counter sale by pharmacists; (2) refilling of prescriptions by pharmacists. As a possible control of the second source the deputy commissioner suggested an alternative: (1) to prohibit the refilling of all prescriptions containing barbiturates, a procedure that admittedly might be highly unpopular; or (2) to undertake an educational campaign among physicians to make more frequent use of their prerogative to limit prescriptions to a single filling. The opinion of the Committee on Public Health was sought concerning the desirability of these proposals.

The committee stated its belief that it was inadvisable to prohibit the refilling of all prescriptions containing barbiturates since such a

policy would work an undue hardship on those patients who might be required to use barbiturates continuously; for example, epileptics. As for the alternative course of action, the committee doubted whether physicians should be asked to antagonize patients by writing "nonrefillable" on prescriptions inasmuch as the physicians' motives would certainly be misconstrued.

The committee recognized two other methods by which the sale of barbiturates might be further controlled: (1) the Sanitary Code might be revised to provide that prescriptions for barbiturates should not be refillable unless the physician indicated otherwise; and, (2) prescriptions for barbiturates might carry an expiration date of 6 months or perhaps a year. Exceptions might be made for prescriptions in which the barbiturate was not the main ingredient.

After consideration of all the aspects, the committee reached the conclusion that the use of barbiturates did not then constitute a sufficient problem in public health to warrant the adoption of any measures for restriction beyond those then in the Sanitary Code. It was believed that the production of barbiturates was not unduly large in view of the number of epileptics. Moreover, the committee reasoned, further control of the sale of barbiturates would not materially reduce the number of suicides, since a person bent on self-destruction by barbiturates could go from physician to physician in order to obtain a sufficient quantity or could resort to other methods of suicide. The committee summarized its position: "In view of the fact that the barbiturates do not present a large public health problem from the point of view of suicides, toxic psychoses, addiction, or chronic poisoning, and since the suggestion for the further control of their sale by the department of health would either work a hardship on those who must use these drugs almost continuously, or would place physicians in an unnecessarily difficult position, or would prove unenforceable, the committee is of the opinion that no revision in the Sanitary Code should

be recommended at the present time."

Because of the reported growth of illicit trade in barbiturates and the increase in accidental poisonings and suicides by them, the Committee on Public Health in 1945 at the request of the commissioner of health of New York City again considered the desirability of extending restrictive measures regarding their sale and distribution. The commissioner submitted to the committee a draft of proposed regulations which had been formulated in cooperation with the New York office of the Federal Bureau of Narcotics.

After studying the problem and the suggested proposals, the committee came to the conclusion that stricter measures of control over the sale and distribution of barbiturates were warranted. The suggested extension of control, however, was not to operate to interfere with the freedom of physicians in their practice; rather, it was aimed to guard against misuse of barbiturates by the dispenser and the user.

The committee recommended the following specific regulations:

1. Prescriptions should be refillable when so indicated by the issuing physician; but such prescriptions should indicate a minimum interval between renewals and the total number of renewals. No prescription containing a barbiturate should be refilled after 6 months from the date of issuance.

2. Pharmacists should not reveal the content or furnish copies of prescriptions to patients.

3. Prescriptions should carry suitable information about the identity of the patient and the prescriber.

4. In an emergency a physician should be allowed to transmit to a pharmacist by telephone a prescription for not more than six average doses of barbiturate drugs provided a written prescription is supplied to the dispensing pharmacist within 72 hours. Should the pharmacist fail to receive such a written confirmation, he should notify the health department of the omission.

5. Proper records of dispensed barbiturates should be kept by physicians, dentists, and veterinarians.

6. Manufacturers, wholesalers, and jobbers should maintain suitable records of sales and distribution, and inventories of stocks.

7. Pharmacists should keep records of bills of purchase of barbiturates and copies of prescriptions on which such drugs were dispensed, including notation of amounts dispensed upon refilling.

8. Barbiturates should not be supplied to any person except on prescription or in the course of legal sale within the drug trade.

All of these recommendations in either their original or a slightly varied form were incorporated into the Sanitary Code by the end of 1947. They are presently in force.

Legislation

New York City

Prior to October 11, 1922, the Sanitary Code contained no specific provision concerning the sale of barbiturates. They were regulated by the provisions applicable to all other drugs. These regulations included:

1. Registration with the New York City Department of Health of non-prescriptive proprietary and patent medicines;

2. Provisions against misbranding, imitation, and substitution; against false and misleading statements; and against failure to disclose alcohol, narcotics, chloroform, chloral hydrate, and acetanilid;

3. Prohibition against dispensing a prescription, decoction, and medication under false or misleading name, direction, or pretense.

In 1922 the board of health adopted section 126 of the Sanitary Code which was entitled "Veronal, etc. sale regulated." This section forbade the sale at retail, except upon written prescription, of veronal, veronal sodium, luminal, and luminal sodium, together with sulphonal, tuinal, and tetranol. Additionally, these substances were designated by chemical name, and provision was made that the section apply to these drugs by whatever name called or known.

In 1940 the Sanitary Code was amended by section 116 on prohibition of manufacture and sale of

adulterated and misbranded drugs which incorporated the provisions of section 502 of the Federal Food, Drug and Cosmetic Act of 1938. This section applied to all drugs.

In the same year the Sanitary Code was further amended by section 118 which regulated more fully the sale of barbiturates in New York City. Barbiturates were included among the drugs which could not be dispensed without a written prescription, and this prescription could not be refilled if it bore an indication to that effect.

The 1945 recommendations of the Committee on Public Health were for the most part adopted by the board of health in 1947 as amendments section 118 b, c, d, and e to the Sanitary Code. Differences from the recommendations were: The life of the original prescription was reduced to 3 months. The recommendation requiring physicians to keep records of barbiturates dispensed was not adopted. Instead, labeling of the container by the physician dispensing barbiturates was specified. The provision allowing for filling of a telephone prescription for barbiturates did not appear in the amendments of 1947 but was adopted in 1948.

New York State

There was no specific legislation on barbiturates or other hypnotic or somnifacient drugs prior to 1939. In that year the Education Law was amended by addition of section 1360a entitled "Hypnotic and Somnifacient Drugs" which by definition included barbiturates. The basic requirement was a written prescription. Later in 1939, article 51 regulating the practice of pharmacy was completely revised to incorporate the provisions of the Federal Food, Drug and Cosmetic Act of 1938 with respect to drugs and cosmetics. During this revision section 1360a was repealed. No specific legislation on barbiturates was again introduced into the Education Law until 1945.

In 1945 a new section 1366a, entitled "Hypnotic and Somnifacient Drugs" was introduced into the Education Law. By definition this section again included barbiturates

and in the main duplicated section 1360a of the 1939 law. The basic requirement was a written prescription. In 1946 section 1366a was newly entitled "Barbiturate and Other Hypnotic and Somnifacient Drugs" and was expanded to essentially its present form. In 1947 following a new revision of the Education Law, section 1366a was renumbered to section 6814. Minor changes were made in the phraseology of the section; and numbering of the subsections was standardized.

Section 6814 has continued to the present without change. It is dissimilar to the committee's recommendations in several respects:

1. It permits a prescription for barbiturates to be refilled unless it bears a direction to the contrary. If the prescriber fails to specify "not to be refilled" or an indication of the refillable time period, then the prescription may be refilled during a period of not more than 6 months. Furthermore, the prescription shall not be refilled prior to the end of the period for which the medication should last.

2. It carries no provision for the physician to dispense barbiturates directly to the patient.

3. It contains no provision requiring the pharmacist to keep records of bills for purchase of barbiturates; and,

4. It does not require manufacturers, wholesalers, and jobbers to maintain a record of amounts of barbiturates received, distributed, or sold.

Section 1747b of the Penal Law of New York State entitled "Sale or Possession of Barbiturate Drugs or Preparations" carries a penalty for unauthorized sale or possession of barbiturate drugs or preparations.

Other States

The Drafting Committee of the Council of State Governments drafted a model bill entitled "Hypnotic or Somnifacient (sleep-producing) Drugs Act" which appeared in its report on Suggested State Legislation Program for 1955. The council is the research and law writing agency of the Conference of State Governors which is held an-

nually to consider methods of achieving greater economy and efficiency in State government. This model law is similar to the recommendations by the Committee on Public Health except in the following particulars: Although it requires that refilling of a prescription must be specifically authorized, it does not specify a minimum interval between renewals, the total number of renewals, and the expiration date of the prescription. On the other hand, it includes a section on penalties. One of the provisions in the model law is similar to that recommendation of the Committee on Public Health which was not adopted in the Sanitary Code; namely, the physician must maintain records of barbiturates distributed by him.

In response to a questionnaire on the model law, the council heard from 34 out of 48 States. Alabama, California, Iowa, Maine, New Jersey, North Carolina, South Carolina, Texas, and Wisconsin indicated that legislation substantially similar to the draft of the model law was approved in each State prior to 1955. Indiana, Massachusetts, Montana, Nebraska, and Rhode Island have indicated that legislation substantially similar to the model act was passed during the 1955 legislative sessions.

Federal

Federal control over the sale of barbiturates is exercised by the United States Food and Drug Administration through application of the misbranded drug and device provisions of the Federal Food, Drug and Cosmetic Act of 1938, sections 502 and 503. Prior to 1951, Food and Drug Administration prosecutions for the sale of barbiturates without prescription rested on the charge of misbranding under section 502 which specified 10 types.

Of these the following four covered in section 502 (b), (d), (e), and (f) should be especially considered: A drug and device in packaged form shall be deemed to be misbranded:

1. Unless it bears a label containing the name and place of business of the manufacturer, packer, or dis-

tributor; and an accurate statement of the quantity of the contents.

2. Unless the label on a narcotic or hypnotic substance bears its name and quantity; and the statement "Warning—May be habit forming." By the terms of the section barbiturates are defined as habit forming.

3. If it is not designated solely by a name recognized in an official compendium, unless its label bears the common or usual name of the drug or each active ingredient, including the quantity or proportion of substances specified in the subsection.

4. Unless its labeling bears adequate directions for use and such adequate warnings against use in instances where it may be unsafe. Under the accompanying regulation of this fourth provision, shipment or delivery of prescription drugs, including barbiturates, were exempted if the label contained the statement "Caution: Federal law prohibits dispensing without prescription."

Section 503 (b) of the Federal Food, Drug and Cosmetic Act of 1938 provided that drugs dispensed on prescription were exempt from the first and third labeling requirements. This section further provided that if the prescription was marked non-refillable or refill was prohibited by law, the drug dispensed was exempt from the requirements that the label carry the name and quantity of narcotic or hypnotic substance, and the statement "Warning—May be habit forming."

In 1951 section 503 (b) was amended by the so-called Durham-Humphrey Act which replaced the previous provisions of that section. This new section provides essentially that:

1. A drug intended for use by man which:

- (a) is a habit-forming drug to which section 502 (d) applies [narcotic and hypnotic substances]; or

- (b) because of its toxicity or other potentiality for harmful effect, is not safe for use except under supervision of a practitioner licensed by law to administer such a drug; or

- (c) is a new drug limited to use under the professional supervision of a practitioner licensed by law to

administer such a drug, shall be dispensed only:

(i) upon a written prescription, or

(ii) upon an oral prescription reduced promptly to writing and filed by the pharmacist, or

(iii) by refilling any written or oral prescription if the refilling is authorized by the prescriber either in the original prescription or by oral order which is reduced promptly to writing and filed by the pharmacist.

A drug dispensed contrary to above provisions shall be deemed misbranded.

2. Any drug dispensed by filling or refilling a written or oral prescription of a practitioner licensed by law to administer such drug shall be exempt from misbranding as specified in section 502, except as to false and misleading labeling, imitation of another drug, substitution, and packaging requirements, if the drug bears a label containing the name and address of the dispenser, the serial number and date of the prescription or of its filling, the name of the prescriber, the name of the patient, the directions for use, and any cautionary statements contained in the prescription.

3. The administrator may by regulation exempt habit forming drugs and new drugs from prescription requirements, when these are not necessary for the protection of public health.

4. A drug which is subject to the prescription requirement shall be deemed to be misbranded if at any time prior to dispensing its label fails to bear the statement: "Caution: Federal law prohibits dispensing without prescription." A drug not subject to prescription shall be deemed to be misbranded if at any time prior to dispensing its label bears the caution statement.

The United States Food and Drug Administration now uses section 503 (b) (1) in prosecuting violative sales of prescription drugs, including sales of barbiturates. It has been noted that the statement "Warning—May be habit forming" was formerly required on labels for both stock and dispensing containers of

barbiturates except when the prescription was marked "nonrefillable" or its refilling was prohibited by law. Under revised section 503 (b), as provided in the Durham-Humphrey Act, barbiturates dispensed on legal prescription do not require the statement "Warning—May be habit forming" on the label of the dispensing container.

It will be noted that the Federal law, while placing barbiturates on the prescription list, controls their manufacture and distribution by specifications of misbranding. Except for the requirement of a prescription, this approach is separate and distinct from that recommended by the Committee on Public Health. Even in the requirement for a prescription, there is no restriction on refilling, such as the minimum interval, number of refillings, and life of the prescription.

When the Durham-Humphrey Act went into effect in 1952, pharmaceutical associations and pharmacy boards in 11 States decided that the laws in their States which control the sale of drugs should be amended to bring them into conformity with the Federal statute. This action was proposed in order to eliminate the confusion to which druggists were subjected in operating under two conflicting statutes. The laws of these States were in conflict with the Federal Durham-Humphrey Act on one or both of two points: prohibition against refilling of barbiturate prescriptions, and against filling telephoned prescriptions, both of which are permitted under the Durham-Humphrey Act.

Whenever State and Federal laws conflict, the stricter law prevails. Unaware of this, some pharmacists have thought that because the Federal law permits the refilling of barbiturate prescriptions and the filling of telephoned barbiturate prescriptions, such practices are proper even though the State law bans them. Harmonizing of the laws would end this confusion. In 20 States no amendment was needed to bring their laws into conformity with the Durham-Humphrey Act. Furthermore, the model State law on barbi-

turates does not conflict with Federal regulations.

Discussion and Conclusions

It is clear that the incidence of both fatal and nonfatal barbiturate poisoning is of such a magnitude that it constitutes a problem in public health. Because it includes poisonings both under accidental circumstances and from suicidal attempt, any plan for reduction must take cognizance of these two separate aspects. It is further evident that the rate of incidence is very much higher in New York City than in the United States.

As a solution to the barbiturate problem there has been a loud demand for Federal supervision, variously expressed as stiffer Federal laws, tighter Federal control over distribution, Federal regulations similar to those for narcotics. But both commercially and pharmacologically, barbiturates are dissimilar to narcotics. It should be remembered that narcotics come from a foreign source and that the basis of control is a revenue measure. In contrast, the barbiturates are domestically produced and the model act now in effect in some States and proposed for all is much stricter; in fact, it could not with reason be much more strict. Certainly the Harrison Act for narcotics is not appropriate for or applicable to barbiturates. If what is wanted is more restrictive Federal legislation because of seeming legal inadequacy in some States, the model act for States should be carefully studied before clamoring for a Federal panacea.

Another form of demand for Federal regulation is that the Narcotics Bureau be given enough money and personnel to carry out a program to control the manufacture, distribution, and sale of barbiturates. To place this responsibility on a bureau that is already overburdened with the gigantic task of coping with illicit narcotic traffic would add an additional handicap that would indeed be formidable. It is asserted that the Narcotics Bureau is most inadequately supported for its present work. Here again the present status

of enforcement of existing State and city laws and the possibilities for the future might well be explored before turning the responsibility too quickly over to a Federal bureau.

It is the opinion of the committee that the model law for States to control barbiturates, which is patterned after its recommendations of 1945, is a highly effective legislative measure containing adequately restrictive provisions. The fault lies not in the terms of this law; indeed, it is much more restrictive and in its approach is capable of exerting much more control than are the existing Federal statutes.

Rather, the present inadequacies in controlling barbiturates are of another kind. They are four in number: First, the model law has not been adopted by all; indeed, not by a majority of the States. This is not just a matter of gross negligence or apathy. It takes time to achieve legislative remedies for social problems. But before judging the adequacy of the model law and the capability of the States to control barbiturates through it, it would seem reasonable that the law be on the books. How can effective control be expected when only 13 States have adopted the measure? How can New York City enforce its model regulations to greatest effect, assuming that it had sufficient personnel, when the rest of New York State and some of the adjoining States are exempt? In view of the demonstrated magnitude of barbiturate poisoning in New York City, the blocking of these loopholes is important. Because of the apparent concentration of the barbiturate problem in urban areas, large cities with home rule in the various States should also have laws patterned after the model act.

Second, in those States which have accepted the model law, it has been so recently adopted that its enforcement has in all probability not reached the level that might be hoped for. But time is not the only reason. Even in New York City with its highly restrictive regulations in effect since 1947, it would require considerable temerity to argue that enforcement has been exemplary. Nor should the health department be

criticized or censured. To examine properly the records of manufacturers, wholesalers, jobbers, and pharmacists requires an adequate staff of inspectors. For this the department has never had the necessary number of personnel. It has only 20 pharmacy inspectors, burdened with many other duties, to patrol 4,000 retail pharmacies and 500 jobbers, wholesalers, and packagers. It is absurd to demand more stringent laws when there is so little provision for enforcement of sufficiently strong existing measures in the Sanitary Code of New York City. More laws will not compensate for an insufficient number of inspectors.

Nor would a vast force be required. A reasonable number of inspectors engaged full time and regularly in auditing the records of pharmacies, wholesalers, and jobbers might soon instill honesty among all transactors, particularly if the element of surprise was utilized. By much the same system bank examiners have exercised a salutary influence. The problem of barbiturate poisoning in New York City has been shown to be proportionately much greater than it is in the Nation. Therefore, if the situation in New York City were improved, it would go far toward reducing the national incidence of barbiturate poisoning.

It is believed that the misuse of barbiturates is concentrated in urban areas, particularly large cities; accordingly, it follows that enforcement efforts should be concentrated there. For that a Federal Bureau is not needed.

Third, ignorance and a casual attitude have been the prevailing atmosphere surrounding barbiturates. The public has been unaware that this valuable family of hypnotics, like almost all other medication, is not without its dangers when misused. Those who know the risk of misuse, the physician and the pharmacist, have apparently not adequately informed or sufficiently impressed the patients about it.

Even after studying the figures on prevalence of use and misuse of barbiturates, the source of supply, and the legislative controls, the

committee is convinced that it has not yet come to the core of the situation. Why is there widespread use and misuse of barbiturate-containing sedatives and sleeping pills? There must be a reason. That widespread practice must be symptomatic of an underlying condition. The committee can only come to the conclusion that there exists all too much unrest, anxiety, and tension in the public.

Under these circumstances, such a radical step as prohibiting the use of the therapeutically valuable barbiturates on the grounds that it would remove a means of self-destruction would not be a sensible action or a sure corrective. With equal reason it might be argued that all high bridges and buildings should be razed, and all gas lines should be disconnected. True, it is an imperative duty to throw every reasonable safeguard around the use of barbiturates. Nevertheless, that is not a true remedy which will bring effective and permanent relief. At best it is treating the symptoms of a disease, not its cause. Now perforce it is the main recourse.

But there must also be a more fundamental approach to the solution. What is needed is a means of preventing the prevalent unrest and anxiety. For that it is necessary to have knowledge about the causes of the emotional manifestations that so abound in society. Furthermore, effective prevention of suicide can come only through an understanding of the factors that bring about a morbid state that leads to a desire for self-destruction. Knowledge on these points can only come through research. Until recently the amount expended for research on mental and emotional disorders was so infinitesimally minute as to be insignificant. Even now the manpower and funds for investigations in this area are so limited in comparison with the transcendent importance of the subject as to make the need a clarion challenge.

In sum, the committee concludes that available model legislation is adequately restrictive, but it has not been widely enough adopted; where it has been put into effect, it has not been enforced. Moreover, such

widespread usage of barbiturates can only indicate extensive unrest, anxiety, and tension in the people. The methods to prevent this situation are still unknown. Finally, the public's knowledge and the general attitude about barbiturates do not now appear to be conducive to a more temperate and reasonable use of barbiturates.

Recommendations

As rational steps toward stopping the misuse of barbiturates and especially reducing the present high rate of incidence of barbiturate poisoning, the Committee on Public

Health offers the following recommendations:

1. The model law controlling the manufacture and distribution of barbiturates should be adopted by all the States. Large cities with home rule should also have laws patterned after this act.

2. A realistic effort toward enforcement of the model law when enacted is an essential step. An adequate staff of inspectors to examine records should be organized. Efforts at enforcement should be concentrated on the large cities, where the rates of incidence of barbiturate poisoning are highest.

3. An educational campaign

should be conducted by health departments, and medical and pharmaceutical societies to remind their members of their responsibility of acquainting patients with the dangers of misuse of barbiturates. At the same time there should be a campaign, using all media, to inform the public of the risks attached to the misuse of barbiturates.

4. Above all, it is highly desirable that adequate funds should be provided to support research on the causes of unrest, anxiety, and tension that are so prevalent among the population and are the basis for such great use and misuse of barbiturates.

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